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FROM FREEDOM TO BONDAGE.*

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OF the many ways in which common-sense inferences about social affairs are flatly contradicted by events (as when measures taken to suppress a book cause increased circulation of it, or as when attempts to prevent usurious rates of interest make the terms harder for the borrower, or as when there is greater difficulty in getting things at the places of production than elsewhere) one of the most curious is the way in which the more things improve the louder become the exclamations about their badness.

In days when the people were without any political power, their subjection was rarely complained of; but after free institutions had so far advanced in England that our political arrangements were envied by continental peoples, the denunciations of aristocratic rule grew gradually stronger, until there came a great widening of the franchise, soon followed by complaints that things were going wrong for want of still further widening. If we trace up the treatment of women from the days of savagedom, when they bore all the burdens and after the men had eaten received such food as remained, up through the middle ages when they served the men at their meals, to our own day when throughout our social arrangements the claims of women are always put first, we see that along with the worst treatment there went the least apparent consciousness that the treatment was bad; while now that they are better treated than ever before, the proclaiming of their grievances daily strengthens: the loudest outcries coming

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from "the paradise of women," America. A century ago, when scarcely a man could be found who was not occasionally intoxicated, and when inability to take one or two bottles of wine brought contempt, no agitation arose against the vice of drunkenness; but now that, in the course of fifty years, the voluntary efforts of temperance societies, joined with more general causes, have produced comparative sobriety, there are vociferous demands for laws to prevent the ruinous effects of the liquor traffic. Similarly again with education. A few generations back, ability to read and write was practically limited to the upper and middle classes, and the suggestion that the rudiments of culture should be given to laborers was never made, or, if made, ridiculed; but when, in the days of our grandfathers, the Sunday-school system, initiated by a few philanthropists, began to spread and was followed by the establishment of day schools, with the result that among the masses those who could read and write were no longer the exceptions, and the demand for cheap literature rapidly increased, there began the cry that the people were perishing for lack of knowledge, and that the State must not simply educate them but must force education upon them.

And so it is, too, with the general state of the population in respect of food, clothing, shelter, and the appliances of life. Leaving out of the comparison early barbaric states, there has been a conspicuous progress from the time when most rustics lived on barley bread, rye bread, and oatmeal, down to our own time when the consumption of white wheaten bread is universal—from the days when coarse jackets reaching to the knees left the legs bare, down to the present day when laboring people, like their employers, have the whole body covered, by two or more layers of clothing—from the old era of single-roomed huts without chimneys, or from the fifteenth century when even an ordinary gentleman's house was commonly without wainscot or plaster on its walls, down to the present century when every cottage has more rooms than one and the houses of artisans usually have several, while all have fireplaces, chimneys, and glazed windows, accompanied mostly by paper-hangings and painted doors; there has been, I say, a conspicuous progress in the condition of the people. And this progress has been still more marked within our own time. Any one who can look back sixty years, when the amount of pauperism was far greater than now and beggars abundant, is struck by the comparative size and finish of the new houses occupied by operatives—by the better dress of workmen, who wear broadcloth on Sundays, and that of servant girls, who vie with their mistresses—by the higher standard of living which leads to a great demand for the best qualities of food by working people: all results of the double change to higher wages and cheaper commodities, and a

distribution of taxes which has relieved the lower classes at the expense of the upper classes. He is struck, too, by the contrast between the small space which popular welfare then occupied in public attention, and the large space it now occupies, with the result that outside and inside Parliament, plans to benefit the millions form the leading topics, and every one having means is expected to join in some philanthropic effort. Yet while elevation, mental and physical, of the masses is going on far more rapidly than ever before—while the lowering of the death-rate proves that the average life is less trying, there swells louder and louder the cry that the evils are so great that nothing short of a social revolution can cure them. In presence of obvious improvements, joined with that increase of longevity which even alone yields conclusive proof of general amelioration, it is proclaimed, with increasing vehemence, that things are so bad that society must be pulled to pieces and reorganized on another plan. In this case, then, as in the previous cases instanced, in proportion as the evil decreases the denunciation of it increases; and as fast as natural causes are shown to be powerful there grows up the belief that they are powerless.

Not that the evils to be remedied are small. Let no one suppose that, by emphasizing the above paradox, I wish to make light of the sufferings which most men have to bear. The fates of the great majority have ever been, and doubtless still are, so sad that it is painful to think of them. Unquestionably the existing type of social organization is one which none who care for their kind can contemplate with satisfaction; and unquestionably men's activities accompanying this type are far from being admirable. The strong divisions of rank and the immense inequalities of means, are at variance with that ideal of human relations on which the sympathetic imagination likes to dwell; and the average conduct, under the pressure and excitement of social life as at present carried on, is in sundry respects repulsive. Though the many who revile competition strangely ignore the enormous benefits resulting from it—though they forget that most of all the appliances and products distinguishing civilization from savagery, and making possible the maintenance of a large population on a small area, have been developed by the struggle for existence—though they disregard the fact that while every man, as producer, suffers from the under-bidding of competitors, yet, as consumer, he is immensely advantaged by the cheapening of all he has to buy—though they persist in dwelling on the evils of competition and saying nothing of its benefits; yet it is not to be denied that the evils are great, and form a large set-off from the benefits. The system under which we at present live fosters dishonesty and lying. It prompts adulterations of countless kinds;

it is answerable for the cheap imitations which eventually in many cases thrust the genuine articles out of the market; it leads to the use of short weights and false measures; it introduces bribery, which vitiates most trading relations, from those of the manufacturer and buyer down to those of the shopkeeper and servant; it encourages deception to such an extent that an assistant who can not tell a falsehood with a good face is blamed; and often it gives the conscientious trader the choice between adopting the malpractices of his competitors, or greatly injuring his creditors by bankruptcy. Moreover, the extensive frauds, common throughout the commercial world and daily exposed in law-courts and newspapers, are largely due to the pressure under which competition places the higher industrial classes; and are otherwise due to that lavish expenditure which, as implying success in the commercial struggle, brings honor. With these minor evils must be joined the major one, that the distribution achieved by the system, gives to those who regulate and superintend, a share of the total produce which bears too large a ratio to the share it gives to the actual workers. Let it not be thought, then, that in saying what I have said above, I under-estimate those vices of our competitive system which, thirty years ago, I described and denounced.* But it is not a question of absolute evils; it is a question of relative evils—whether the evils at present suffered are or are not less than the evils which would be suffered under another system—whether efforts for mitigation along the lines thus far followed are not more likely to succeed than efforts along utterly different lines.

This is the question here to be considered. I must be excused for first of all setting forth sundry truths which are, to some at any rate, tolerably familiar, before proceeding to draw inferences which are not so familiar.

Speaking broadly, every man works that he may avoid suffering. Here, remembrance of the pangs of hunger prompts him; and there, he is prompted by the sight of the slave-driver's lash. His immediate dread may be the punishment which physical circumstances will inflict, or may be punishment inflicted by human agency. He must have a master; but the master may be Nature or may be a fellow-man. When he is under the impersonal coercion of Nature, we say that he is free; and when he is under the personal coercion of some one above him, we call him, according to the degree of his dependence, a slave, a serf, or a vassal. Of course I omit the small minority who inherit means: an incidental, and not a necessary, social element. I speak only of the vast majority, both cultured and uncultured, who maintain them-

* See essay on The Morals of Trade.

selves by labor, bodily or mental, and must either exert themselves of their own unconstrained wills, prompted only by thoughts of naturally-resulting evils or benefits, or must exert themselves with constrained wills, prompted by thoughts of evils and benefits artificially resulting.

Men may work together in a society under either of these two forms of control: forms which, though in many cases mingled, are essentially contrasted. Using the word co-operation in its wide sense, and not in that restricted sense now commonly given to it, we may say that social life must be carried on by either voluntary co-operation or compulsory co-operation; or, to use Sir Henry Maine's words, the system must be that of *contract* or that of *status*—that in which the individual is left to do the best he can by his spontaneous efforts and get success or failure according to his efficiency, and that in which he has his appointed place, works under coercive rule, and has his apportioned share of food, clothing, and shelter.

The system of voluntary co-operation is that by which, in civilized societies, industry is now everywhere carried on. Under a simple form we have it on every farm, where the laborers, paid by the farmer himself and taking orders directly from him, are free to stay or go as they please. And of its more complex form an example is yielded by every manufacturing concern, in which, under partners, come clerks and managers, and under these, timekeepers and over-lookers, and under these operatives of different grades. In each of these cases there is an obvious working together, or co-operation, of employer and employed, to obtain in one case a crop and in the other case a manufactured stock. And then, at the same time, there is a far more extensive, though unconscious, co-operation with other workers of all grades throughout the society. For while these particular employers and employed are severally occupied with their special kinds of work, other employers and employed are making other things needed for the carrying on of their lives as well as the lives of all others. This voluntary co-operation, from its simplest to its most complex forms, has the common trait that those concerned work together by consent. There is no one to force terms or to force acceptance. It is perfectly true that in many cases an employer may give, or an employé may accept, with reluctance: circumstances he says compel him. But what are the circumstances? In the one case there are goods ordered, or a contract entered into, which he can not supply or execute without yielding; and in the other case he submits to a wage less than he likes because otherwise he will have no money wherewith to procure food and warmth. The general formula is not—"Do this, or I will make you"; but it is—"Do this, or leave your place and take the consequences."

On the other hand compulsory co-operation is exemplified by an army—not so much by our own army, the service in which is under agreement for a specified period, but in a continental army, raised by conscription. Here, in time of peace the daily duties—cleaning, parade, drill, sentry work, and the rest—and in time of war the various actions of the camp and the battle-field, are done under command, without room for any exercise of choice. Up from the private soldier through the non-commissioned officers and the half-dozen or more grades of commissioned officers, the universal law is absolute obedience from the grade below to the grade above. The sphere of individual will is such only as is allowed by the will of the superior. Breaches of subordination are, according to their gravity, dealt with by deprivation of leave, extra drill, imprisonment, flogging, and, in the last resort, shooting. Instead of the understanding that there must be obedience in respect of specified duties under pain of dismissal, the understanding now is—"Obey in everything ordered under penalty of inflicted suffering and perhaps death."

This form of co-operation, still exemplified in an army, has in days gone by been the form of co-operation throughout the civil population. Everywhere, and at all times, chronic war generates a militant type of structure, not in the body of soldiers only, but throughout the community at large. Practically, while the conflict between societies is actively going on, and fighting is regarded as the only manly occupation, the society is the quiescent army and the army the mobilized society: that part which does not take part in battle, composed of slaves, serfs, women, etc., constituting the commissariat. Naturally, therefore, throughout the mass of inferior individuals constituting the commissariat, there is maintained a system of discipline identical in nature if less elaborate. The fighting body being, under such conditions, the ruling body, and the rest of the community being incapable of resistance, those who control the fighting body will, of course, impose their control upon the non-fighting body; and the *régime* of coercion will be applied to it with such modifications only as the different circumstances involve. Prisoners of war become slaves. Those who were free cultivators before the conquest of their country, become serfs attached to the soil. Petty chiefs become subject to superior chiefs; these smaller lords become vassals to over-lords; and so on up to the highest: the social ranks and powers being of like essential nature with the ranks and powers throughout the military organization. And while for the slaves compulsory co-operation is the unqualified system, a co-operation which is in part compulsory is the system that pervades all grades above. Each man's oath of fealty to his suzerain takes the form—"I am your man."

Throughout Europe, and especially in our own country, this system of compulsory co-operation gradually relaxed in rigor, while the system of voluntary co-operation step by step replaced it. As fast as war ceased to be the business of life, the social structure produced by war and appropriate to it, slowly became qualified by the social structure produced by industrial life and appropriate to it. In proportion as a decreasing part of the community was devoted to offensive and defensive activities, an increasing part became devoted to production and distribution. Growing more numerous, more powerful, and taking refuge in towns where it was less under the power of the militant class, this industrial population carried on its life under the system of voluntary co-operation. Though municipal governments and guild-regulations, partially pervaded by ideas and usages derived from the militant type of society, were in some degree coercive; yet production and distribution were in the main carried on under agreement—alike between buyers and sellers, and between masters and workmen. As fast as these social relations and forms of activity became dominant in urban populations, they influenced the whole community: compulsory co-operation lapsed more and more, through money commutation for services, military and civil; while divisions of rank became less rigid and class-power diminished. Until at length, restraints exercised by incorporated trades have fallen into desuetude, as well as the rule of rank over rank, voluntary co-operation became the universal principle. Purchase and sale became the law for all kinds of services as well as for all kinds of commodities.

The restlessness generated by pressure against the conditions of existence, perpetually prompts the desire to try a new position. Every one knows how long-continued rest in one attitude becomes wearisome—every one has found how even the best easy-chair, at first rejoiced in, becomes after many hours intolerable; and change to a hard seat, previously occupied and rejected, seems for a time to be a great relief. It is the same with incorporated humanity. Having by long struggles emancipated itself from the hard discipline of the ancient *régime*, and having discovered that the new *régime* into which it has grown, though relatively easy, is not without stresses and pains, its impatience with these prompts the wish to try another system; which other system is, in principle if not in appearance, the same as that which during past generations was escaped from with much rejoicing.

For as fast as the *régime* of contract is discarded the *régime* of status is of necessity adopted. As fast as voluntary co-operation is abandoned compulsory co-operation must be substituted. Some kind of organization labor must have; and if it is not that

which arises by agreement under free competition, it must be that which is imposed by authority. Unlike in appearance and names as it may be to the old order of slaves and serfs, working under masters, who were coerced by barons, who were themselves vassals of dukes or kings, the new order wished for, constituted by workers under foremen of small groups, overlooked by superintendents, who are subject to higher local managers, who are controlled by superiors of districts, themselves under a central government, must be essentially the same in principle. In one case, as in the other, there must be established grades, and enforced subordination of each grade to the grades above. This is a truth which the communist or the socialist does not dwell upon. Angry with the existing system under which each of us takes care of himself, while all of us see that each has fair play, he thinks how much better it would be for all of us to take care of each of us; and he refrains from thinking of the machinery by which this is to be done. Inevitably, if each is to be cared for by all, then the embodied all must get the means—the necessaries of life. What it gives to each must be taken from the accumulated contributions; and it must therefore require from each his proportion—must tell him how much he has to give to the general stock in the shape of production, that he may have so much in the shape of sustentation. Hence, before he can be provided for, he must put himself under orders, and obey those who say what he shall do, and at what hours, and where; and who give him his share of food, clothing, and shelter. If competition is excluded, and with it buying and selling, there can be no voluntary exchange of so much labor for so much produce; but there must be apportionment of the one to the other by appointed officers. This apportionment must be enforced. Without alternative the work must be done, and without alternative the benefit, whatever it may be, must be accepted. For the worker may not leave his place at will and offer himself elsewhere. Under such a system he can not be accepted elsewhere, save by order of the authorities. And it is manifest that a standing order would forbid employment in one place of an insubordinate member from another place: the system could not be worked if the workers were severally allowed to go or come as they pleased. With corporals and sergeants under them, the captains of industry must carry out the orders of their colonels, and these of their generals, up to the council of the commander-in-chief; and obedience must be required throughout the industrial army as throughout a fighting army. "Do your prescribed duties, and take your apportioned rations," must be the rule of the one as of the other.

"Well, be it so," replies the socialist. "The workers will appoint their own officers, and these will always be subject to

criticisms of the mass they regulate. Being thus in fear of public opinion, they will be sure to act judiciously and fairly; or when they do not, will be deposed by the popular vote, local or general. Where will be the grievance of being under superiors, when the superiors themselves are under democratic control?" And in this attractive vision the socialist has full belief.

Iron and brass are simpler things than flesh and blood, and dead wood than living nerve; and a machine constructed of the one works in more definite ways than an organism constructed of the other,—especially when the machine is worked by the inorganic forces of steam or water, while the organism is worked by the forces of living nerve-centers. Manifestly, then, the ways in which the machine will work are much more readily calculable than the ways in which the organism will work. Yet in how few cases does the inventor foresee rightly the actions of his new apparatus! Read the patent-list, and it will be found that not more than one device in fifty turns out to be of any service. Plausible as his scheme seemed to the inventor, one or other hitch prevents the intended operation, and brings out a widely different result from that which he wished.

What, then, shall we say of these schemes which have to do not with dead matters and forces, but with complex living organisms working in ways less readily foreseen, and which involve the co-operation of multitudes of such organisms? Even the units out of which this re-arranged body politic is to be formed are often incomprehensible. Every one is from time to time surprised by others' behavior, and even by the deeds of relatives who are best known to him. Seeing, then, how uncertainly any one can foresee the actions of an individual, how can he with any certainty foresee the operation of a social structure? He proceeds on the assumption that all concerned will judge rightly and act fairly—will think as they ought to think, and act as they ought to act; and he assumes this regardless of the daily experiences which show him that men do neither the one nor the other, and forgetting that the complaints he makes against the existing system show his belief to be that men have neither the wisdom nor the rectitude which his plan requires them to have.

Paper constitutions raise smiles on the faces of those who have observed their results; and paper social systems similarly affect those who have contemplated the available evidence. How little the men who wrought the French revolution and were chiefly concerned in setting up the new governmental apparatus, dreamt that one of the early actions of this apparatus would be to behead them all! How little the men who drew up the American Declaration of Independence and framed the Republic, anticipated that after some generations the legislature would lapse

into the hands of wire-pullers; that its doings would turn upon the contests of office-seekers; that political action would be everywhere vitiated by the intrusiou of a foreign element holding the balance between parties; that electors, instead of judging for themselves, would habitually be led to the polls in thousands by their "bosses"; and that respectable men would be driven out of public life by the insults and slanders of professional politicians. Nor were there better previsions in those who gave constitutions to the various other states of the New World, in which unnumbered revolutions have shown with wonderful persistence the contrasts between the expected results of political systems and the achieved results. It has been no less thus with proposed systems of social re-organization, so far as they have been tried. Save where celibacy has been insisted on, their history has been everywhere one of disaster; ending with the history of Cabet's Icarian colony lately given by one of its members, Madame Fleury Robinson, in The Open Court—a history of splittings, re-splittings, re-re-splittings, accompanied by numerous individual secessions and final dissolution. And for the failure of such social schemes, as for the failure of the political schemes, there has been one general cause.

Metamorphosis is the universal law, exemplified throughout the Heavens and on the Earth: especially throughout the organic world; and above all in the animal division of it. No creature, save the simplest and most minute, commences its existence in a form like that which it eventually assumes; and in most cases the unlikeness is great—so great that kinship between the first and the last forms would be incredible were it not daily demonstrated in every poultry-yard and every garden. More than this is true. The changes of form are often several: each of them being an apparently complete transformation—egg, larva, pupa, imago, for example. And this universal metamorphosis, displayed alike in the development of a planet and of every seed which germinates on its surface, holds also of societies, whether taken as wholes or in their separate institutions. No one of them ends as it begins; and the difference between its original structure and its ultimate structure is such that, at the outset, change of the one into the other would have seemed incredible. In the rudest tribe the chief, obeyed as leader in war, loses his distinctive position when the fighting is over; and even where continued warfare has produced permanent chieftainship, the chief, building his own hut, getting his own food, making his own implements, differs from others only by his predominant influence. There is no sign that in course of time, by conquests and unions of tribes, and consolidations of clusters so formed with other such clusters, until a nation has been produced, there will originate from the primitive chief,

one who, as czar or emperor, surrounded with pomp and ceremony, has despotic power over scores of millions, exercised through hundreds of thousands of soldiers and hundreds of thousands of officials. When the early Christian missionaries, having humble externals and passing self-denying lives, spread over pagan Europe, preaching forgiveness of injuries and the returning of good for evil, no one dreamt that in course of time their representatives would form a vast hierarchy, possessing everywhere a large part of the land, distinguished by the haughtiness of its members grade above grade, ruled by military bishops who led their retainers to battle, and headed by a pope exercising supreme power over kings. So, too, has it been with that very industrial system which many are now so eager to replace. In its original form there was no prophecy of the factory system or kindred organizations of workers. Differing from them only as being the head of his house, the master worked along with his apprentices and a journeyman or two, sharing with them his table and accommodation, and himself selling their joint produce. Only with industrial growth did there come employment of a larger number of assistants and a relinquishment, on the part of the master, of all other business than that of superintendence. And only in the course of recent times did there evolve the organizations under which the labors of hundreds and thousands of men receiving wages, are regulated by various orders of paid officials under a single or multiple head. These originally small, semi-socialistic, groups of producers, like the compound families or house-communities of early ages, slowly dissolved because they could not hold their ground: the larger establishments, with better subdivision of labor, succeeded because they ministered to the wants of society more effectually. But we need not go back through the centuries to trace transformations sufficiently great and unexpected. On the day when £30,000 a year in aid of education was voted as an experiment, the name of idiot would have been given to an opponent who prophesied that in fifty years the sum spent through imperial taxes and local rates would amount to £10,000,000, or who said that the aid to education would be followed by aids to feeding and clothing, or who said that parents and children, alike deprived of all option, would, even if starving, be compelled by fine or imprisonment to conform, and receive that which, with papal assumption, the State calls education. No one, I say, would have dreamt that out of so innocent-looking a germ would have so quickly evolved this tyrannical system, tamely submitted to by people who fancy themselves free.

Thus in social arrangements, as in all other things, change is inevitable. It is foolish to suppose that new institutions set up,

will long retain the character given them by those who set them up. Rapidly or slowly they will be transformed into institutions unlike those intended—so unlike as even to be unrecognizable by their devisers. And what, in the case before us, will be the metamorphosis? The answer pointed to by instances above given, and warranted by various analogies, is manifest.

A cardinal trait in all advancing organization is the development of the regulative apparatus. If the parts of a whole are to act together, there must be appliances by which their actions are directed; and in proportion as the whole is large and complex, and has many requirements to be met by many agencies, the directive apparatus must be extensive, elaborate, and powerful. That it is thus with individual organisms needs no saying; and that it must be thus with social organisms is obvious. Beyond the regulative apparatus such as in our own society is required for carrying on national defense and maintaining public order and personal safety, there must, under the *régime* of socialism, be a regulative apparatus everywhere controlling all kinds of production and distribution, and everywhere apportioning the shares of products of each kind required for each locality, each working establishment, each individual. Under our existing voluntary co-operation, with its free contracts and its competition, production and distribution need no official oversight. Demand and supply, and the desire of each man to gain a living by supplying the needs of his fellows, spontaneously evolve that wonderful system whereby a great city has its food daily brought round to all doors or stored at adjacent shops; has clothing for its citizens everywhere at hand in multitudinous varieties; has its houses and furniture and fuel ready made or stocked in each locality; and has mental pabulum from halfpenny papers, hourly hawked round, to weekly shoals of novels, and less abundant books of instruction, furnished without stint for small payments. And throughout the kingdom, production as well as distribution is similarly carried on with the smallest amount of superintendence which proves efficient; while the quantities of the numerous commodities required daily in each locality are adjusted without any other agency than the pursuit of profit. Suppose now that this industrial *régime* of willinghood, acting spontaneously, is replaced by a *régime* of industrial obedience, enforced by public officials. Imagine the vast administration required for that distribution of all commodities to all people in every city, town, and village, which is now effected by traders! Imagine, again, the still more vast administration required for doing all that farmers, manufacturers, and merchants do; having not only its various orders of local superintendents, but its sub-centers and chief centers needed for apportioning the quantities of each thing every-

where needed, and the adjustment of them to the requisite times. Then add the staffs wanted for working mines, railways, roads, canals; the staffs required for conducting the importing and exporting businesses and the administration of mercantile shipping; the staffs required for supplying towns not only with water and gas but with locomotion by tramways, omnibuses, and other vehicles, and for the distribution of power, electric and other. Join with these the existing postal, telegraphic, and telephonic administrations; and finally those of the police and army, by which the dictates of this immense consolidated regulative system are to be everywhere enforced. Imagine all this and then ask what will be the position of the actual workers! Already on the continent, where governmental organizations are more elaborate and coercive than here, there are chronic complaints of the tyranny of bureaucracies—the *hauteur* and brutality of their members. What will these become when not only the more public actions of citizens are controlled, but there is added this far more extensive control of all their respective daily duties? What will happen when the various divisions of this vast army of officials, united by interests common to officialism—the interests of the regulators *versus* those of the regulated—have at their command whatever force is needful to suppress insubordination and act as "saviors of society"? Where will be the actual diggers and miners and smelters and weavers, when those who order and superintend, everywhere arranged class above class, have come, after some generations, to intermarry with those of kindred grades, under feelings such as are operative in existing classes; and when there have been so produced a series of castes rising in superiority; and when all these, having everything in their own power, have arranged modes of living for their own advantage: eventually forming a new aristocracy far more elaborate and better organized than the old? How will the individual worker fare if he is dissatisfied with his treatment—thinks that he has not an adequate share of the products, or has more to do than can rightly be demanded, or wishes to undertake a function for which he feels himself fitted but which is not thought proper for him by his superiors, or desires to make an independent career for himself? This dissatisfied unit in the immense machine will be told he must submit or go. The mildest penalty for disobedience will be industrial excommunication. And if an international organization of labor is formed as proposed, exclusion in one country will mean exclusion in all others—industrial excommunication will mean starvation.

That things must take this course is a conclusion reached not by deduction only, nor only by induction from those experiences

of the past instanced above, nor only from consideration of the analogies furnished by organisms of all orders; but it is reached also by observation of cases daily under our eyes. The truth that the regulative structure always tends to increase in power, is illustrated by every established body of men. The history of each learned society, or society for other purpose, shows how the staff, permanent or partially permanent, sways the proceedings and determines the actions of the society with but little resistance, even when most members of the society disapprove: the repugnance to anything like a revolutionary step being ordinarily an efficient deterrent. So is it with joint-stock companies—those owning railways for example. The plans of a board of directors are usually authorized with little or no discussion; and if there is any considerable opposition, this is forthwith crushed by an overwhelming number of proxies sent by those who always support the existing administration. Only when the misconduct is extreme does the resistance of shareholders suffice to displace the ruling body. Nor is it otherwise with societies formed of workingmen and having the interests of labor especially at heart—the Trades Unions. In these, too, the regulative agency becomes all-powerful. Their members, even when they dissent from the policy pursued, habitually yield to the authorities they have set up. As they can not secede without making enemies of their fellow-workmen, and often losing all chance of employment, they succumb. We are shown, too, by the late congress, that already in the general organization of Trades Unions so recently formed, there are complaints of "wire-pullers" and "bosses" and "permanent officials." If, then, this supremacy of the regulators is seen in bodies of quite modern origin, formed of men who have, in many of the cases instanced, unhindered powers of asserting their independence, what will the supremacy of the regulators become in long-established bodies, in bodies which have grown vast and highly organized, and in bodies which, instead of controlling only a small part of the unit's life, control the whole of his life?

Again there will come the rejoinder—"We shall guard against all that. Everybody will be educated; and all, with their eyes constantly open to the abuse of power, will be quick to prevent it." The worth of these expectations would be small even could we not identify the causes which will bring disappointment; for in human affairs the most promising schemes go wrong in ways which no one anticipated. But in this case the going wrong will be necessitated by causes which are conspicuous. The working of institutions is determined by men's characters; and the existing defects in their characters will inevitably bring about the results above indicated. There is no adequate

endowment of those sentiments required to prevent the growth of a despotic bureaucracy.

Were it needful to dwell on indirect evidence, much might be made of that furnished by the behavior of the so-called Liberal party—a party which, relinquishing the original conception of a leader as a mouthpiece for a known and accepted policy, thinks itself bound to accept a policy which its leader springs upon it without consent or warning—a party so utterly without the feeling and idea implied by liberalism, as not to resent this trampling on the right of private judgment which constitutes the root of liberalism—nay, a party which vilifies as renegade liberals, those of its members who refuse to surrender their independence! But without occupying space with indirect proofs that the mass of men have not the natures required to check the development of tyrannical officialism, it will suffice to contemplate the direct proofs furnished by those classes among whom the socialistic idea most predominates, and who think themselves most interested in propagating it—the operative classes. These would constitute the great body of socialistic organization, and their characters would determine its nature. What, then, are their characters as displayed in such organizations as they have already formed?

Instead of the selfishness of the employing classes and the selfishness of competition, we are to have the unselfishness of a mutual-aiding system. How far is this unselfishness now shown in the behavior of workingmen to one another? What shall we say to the rules limiting the numbers of new hands admitted into each trade, or to the rules which hinder ascent from inferior classes of workers to superior classes? One does not see in such regulations any of that altruism by which socialism is to be pervaded. Contrariwise, one sees a pursuit of private interests no less keen than among traders. Hence, unless we suppose that men's natures will be suddenly exalted, we must conclude that the pursuit of private interests will sway the doings of all the component classes in a socialistic society.

With passive disregard of others' claims goes active encroachment on them. "Be one of us or we will cut off your means of living," is the usual threat of each Trades Union to outsiders of the same trade. While their members insist on their own freedom to combine and fix the rates at which they will work (as they are perfectly justified in doing), the freedom of those who disagree with them is not only denied but the assertion of it is treated as a crime. Individuals who maintain their rights to make their own contracts are vilified as "blacklegs" and "traitors," and meet with violence which would be merciless were there no legal penalties and no police. Along with this trampling on the liberties of men of their own class, there goes peremptory dictation to

the employing class: not prescribed terms and working arrangements only shall be conformed to, but none save those belonging to their body shall be employed—nay, in some cases, there shall be a strike if the employer carries on transactions with trading bodies that give work to non-union men. Here, then, we are variously shown by Trades Unions, or at any rate by the newer Trades Unions, a determination to impose their regulations without regard to the rights of those who are to be coerced. So complete is the inversion of ideas and sentiments that maintenance of these rights is regarded as vicious and trespass upon them as virtuous.*

Along with this aggressiveness in one direction there goes submissiveness in another direction. The coercion of outsiders by unionists is paralleled only by their subjection to their leaders. That they may conquer in the struggle they surrender their individual liberties and individual judgments, and show no resentment however dictatorial may be the rule exercised over them. Everywhere we see such subordination that bodies of workmen unanimously leave their work or return to it as their authorities order them. Nor do they resist when taxed all round to support strikers whose acts they may or may not approve, but instead, ill-treat recalcitrant members of their body who do not subscribe.

The traits thus shown must be operative in any new social organization, and the question to be asked is—What will result from their operation when they are relieved from all restraints? At present the separate bodies of men displaying them are in the midst of a society partially passive, partially antagonistic; are subject to the criticisms and reprobations of an independent press; and are under the control of law, enforced by police. If in these circumstances these bodies habitually take courses which override individual freedom, what will happen when, instead of being only scattered parts of the community, governed by their

* Marvelous are the conclusions men reach when once they desert the simple principle, that each man should be allowed to pursue the objects of life, restrained only by the limits which the similar pursuits of their objects by other men impose. A generation ago we heard loud assertions of "the right to labor," that is, the right to have labor provided; and there are still not a few who think the community bound to find work for each person. Compare this with the doctrine current in France at the time when the monarchical power culminated; namely, that "the right of working is a royal right which the prince can sell and the subjects must buy." This contrast is startling enough; but a contrast still more startling is being provided for us. We now see a resuscitation of the despotic doctrine, differing only by the substitution of Trades Unions for kings. For now that Trades Unions are becoming universal, and each artisan has to pay prescribed moneys to one or another of them, with the alternative of being a non-unionist to whom work is denied by force, it has come to this, that the right to labor is a Trade-Union right, which the Trade Union can sell and the individual worker must buy!

separate sets of regulators, they constitute the whole community, governed by a consolidated system of such regulators, when functionaries of all orders, including those who officer the press, form parts of the regulative organization; and when the law is both enacted and administered by this regulative organization? The fanatical adherents of a social theory are capable of taking any measures, no matter how extreme, for carrying out their views: holding, like the merciless priesthoods of past times, that the end justifies the means. And when a general socialistic organization has been established, the vast, ramified, and consolidated body of those who direct its activities, using without check whatever coercion seems to them needful in the interests of the system (which will practically become their own interests), will have no hesitation in imposing their rigorous rule over the entire lives of the actual workers; until, eventually, there is developed an official oligarchy, with its various grades, exercising a tyranny more gigantic and more terrible than any which the world has seen.

Let me again repudiate an erroneous inference. Any one who supposes that the foregoing argument implies contentment with things as they are, makes a profound mistake. The present social state is transitional, as past social states have been transitional. There will, I hope and believe, come a future social state differing as much from the present as the present differs from the past with its mailed barons and defenseless serfs. In Social Statics, as well as in The Study of Sociology and in Political Institutions, is clearly shown the desire for an organization more conducive to the happiness of men at large than that which exists. My opposition to socialism results from the belief that it would stop the progress to such a higher state and bring back a lower state. Nothing but the slow modification of human nature by the discipline of social life, can produce permanently advantageous changes.

A fundamental error pervading the thinking of nearly all parties, political and social, is that evils admit of immediate and radical remedies. "If you will but do this, the mischief will be prevented." "Adopt my plan and the suffering will disappear." "The corruption will unquestionably be cured by enforcing this measure." Everywhere one meets with beliefs, expressed or implied, of these kinds. They are all ill-founded. It is possible to remove causes which intensify the evils; it is possible to change the evils from one form into another; and it is possible, and very common, to exacerbate the evils by the efforts made to prevent them; but anything like immediate cure is impossible. In the course of thousands of years mankind have, by multiplication, been forced out of that original savage state in which small numbers supported themselves on wild food, into the

civilized state in which the food required for supporting great numbers can be got only by continuous labor. The nature required for this last mode of life is widely different from the nature required for the first; and long-continued pains have to be passed through in remolding the one into the other. Misery has necessarily to be borne by a constitution out of harmony with its conditions; and a constitution inherited from primitive men is out of harmony with the conditions imposed on existing men. Hence it is impossible to establish forthwith a satisfactory social state. No such nature as that which has filled Europe with millions of armed men, here eager for conquest and there for revenge—no such nature as that which prompts the nations called Christian to vie with one another in filibustering expeditions all over the world, regardless of the claims of aborigines, while their tens of thousands of priests of the religion of love look on approvingly—no such nature as that which, in dealing with weaker races, goes beyond the primitive rule of life for life, and for one life takes many lives—no such nature, I say, can, by any device, be framed into a harmonious community. The root of all well-ordered social action is a sentiment of justice, which at once insists on personal freedom and is solicitous for the like freedom of others; and there at present exists but a very inadequate amount of this sentiment.

Hence the need for further long continuance of a social discipline which requires each man to carry on his activities with due regard to the like claims of others to carry on their activities; and which, while it insists that he shall have all the benefits his conduct naturally brings, insists also that he shall not saddle on others the evils his conduct naturally brings: unless they freely undertake to bear them. And hence the belief that endeavors to elude this discipline will not only fail, but will bring worse evils than those to be escaped.

It is not, then, chiefly in the interests of the employing classes that socialism is to be resisted, but much more in the interests of the employed classes. In one way or other production must be regulated; and the regulators, in the nature of things, must always be a small class as compared with the actual producers. Under voluntary co-operation as at present carried on, the regulators, pursuing their personal interests, take as large a share of the produce as they can get; but, as we are daily shown by Trades-Union successes, are restrained in the selfish pursuit of their ends. Under that compulsory co-operation which socialism would necessitate, the regulators, pursuing their personal interests with no less selfishness, could not be met by the combined resistance of free workers; and their power, unchecked as now by refusals to work save on prescribed terms, would grow and ramify and consolidate till it became irresistible. The ultimate result, as I have

before pointed out, must be a society like that of ancient Peru, dreadful to contemplate, in which the mass of the people, elaborately regimented in groups of 10, 50, 100, 500, and 1,000, ruled by officers of corresponding grades, and tied to their districts, were superintended in their private lives as well as in their industries, and toiled hopelessly for the support of the governmental organization.

A BRIEF HISTORY OF THE OHIO RIVER.

By Prof. JOSEPH F. JAMES, M. Sc.

FAR up in one of the wildest regions of eastern North America rise most of the streams which form the Ohio River. These streams are separated from the head-waters of the Potomac by a spur of the Appalachian Mountains only a few miles wide. This region, in Randolph County, West Virginia, was called, many years ago, and, for aught I can say to the contrary, may still be known as "Canaan." It is a wild, undeveloped tract of thousands of acres, with many deer and bears; surrounded by rugged mountains, abounding in leaping trout-streams, and full of laurel brakes impenetrable alike to man and beast. Within these precincts are the sources of one of the great rivers of the continent.

The picturesque birth of the Ohio River is a fitting prelude to its romantic history. Its physical history is almost that of the continent, for its birth dates back to a time when a large part of eastern North America rose for the last time above the surface of the sea. Centuries ago its valley was the home of the hairy mammoth and the lordly mastodon. In later times it saw the bison in countless herds reflected in its waters. The mound-builders have left some of their most wonderful works within the confines of its valley. Later still, its hills have re-echoed the shouts and battle-cries of Indian and of white; and now the hum of industry and the homes of civilized man fill its valley from end to end. "La belle rivière" it still remains, and to this it might add another epithet, "La méchante rivière" (or the wayward river), because of its astonishing variations in volume of water.

The Ohio River proper results from the union of two streams in the western portion of Pennsylvania. One of these—the Monongahela—rises in that "Canaan" already referred to, and is in its turn formed of two branches, the Cheat and the Tygart's Valley Rivers. These are formed again of minor streams, whose ultimate sources lie along the back-bone or high ridge which separates the sources of the rivers of the Atlantic coast from those of the Mississippi Valley. The Cheat is a wild and romantic stream,

particularly at its head-waters, where it tumbles over and around rocks in the wild and reckless exuberance of youth. It abounds with trout, and furnishes scenery well worthy the attention of artist or student of nature.

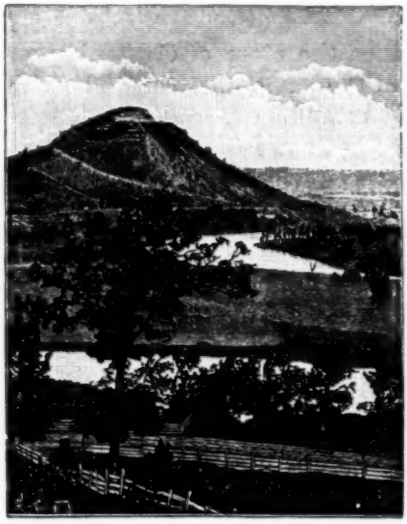
The Monongahela itself has become somewhat celebrated of late years, because of certain terraces found along its banks, the history of which has been the source of considerable speculation. They are found in the vicinity of Morgantown, W. Va., and are composed of silt, clay, and loam, with a few animal and many plant remains scattered throughout their extent. They vary from 70 to 275 feet above low water in the river, but have an approximate elevation of from 1,045 to 1,065 feet above tide. Evidently produced by the action of water, they are yet too far removed from the present stream to have been formed by its agency, at least in its present condition. An explanation of their origin will be suggested later on in the course of this article.

The other branch, which unites with the Monongahela, is the Alleghany. This takes its rise in the northwestern part of Pennsylvania, enters New York State for a short distance, turns south again, and joins its sister stream at Pittsburg. It does not rise in a mountainous country, but in a region comparatively level; and there is every reason to believe at one time in its existence it was tributary to Lake Erie instead of to the Ohio. It is some four hundred miles long, and is navigable for small boats for two hundred and fifty miles from its mouth. It flows through the great oil and gas region of Pennsylvania, a region which gave to the world over 150,000,000 barrels of petroleum. It is from here, too, that has come the gaseous fuel which has changed Pittsburg from the smokiest city of the Nation into one of the cleanest. Pittsburg, besides being a great manufacturing center, is the starting-point for the great coal fleets that supply the cities of Cincinnati, Louisville, and hundreds of others with the fuel taken from the mines of Pennsylvania. From this point begins the Ohio River proper. We may glance now at its history, and trace briefly the vicissitudes through which it has passed from its birth to the present time.

The actual birth of the Ohio River dates from the close of the Carboniferous or Coal era, and the final elevation of the Appalachian chain of mountains. Previous to that time the country through which the river now flows lay upon the borders of the ocean, and in places was lost in the ocean itself. After the land was elevated above the sea-level, the drainage system of the valley was established, and the great river was born.

All streams in the course of their existence go through several phases, which correspond to the features presented by the different parts of their course. The head-waters are swift and roaring tor-

rents, leaping from ledge to ledge, or dashing round and over masses of rock in their wild mountain homes. Lower down the current slackens, some of the impetuosity is lost, but it still glides swiftly over its rocky bed. Still lower down the current becomes slower, the stream broadens out, and the bed loses its rocky and



IDEAL VIEW OF AN OLD UNGLACIATED COUNTRY, SHOWING THE FORM ASSUMED BY THE EMINENCES WHEN EROSION HAS PROCEEDED TO A GREAT EXTENT. (United States Geological Survey.) (Chamberlin.)

A COUNTRY, IN CONTRAST WITH THE ADJACENT FIGURE, IN WHICH THE DRAINAGE HAS BEEN DISTURBED BY GLACIAL DEPOSITS, AND THE STREAMS ARE BEGINNING TO WEAR NEW CHANNELS. (Chamberlin.)

rugged character; while as the mouth is approached the current becomes sluggish, broad bottoms appear, a greater width to the stream is apparent, and all signs point to the end of its career. As with the course of a river, so with its life. In early days, before the channel is well defined, it is a foaming torrent. Later on it smooths its bed and becomes more stable in position. As years and centuries pass away, the rougher places are leveled, and the stream then flows placidly in its course over its well-worn, often deeply excavated channel. The Ohio has reached this last stage in its history, for at only a single place in all its course from Pittsburg to its mouth does its channel show signs of a rocky character. The reason for this single exception will soon become clear.

An examination of the geological structure of the country through which the Ohio flows shows none but the extreme end of the valley to be of later age than the Carboniferous. Portions are, indeed, far older; but the area covered by these, though perhaps extensive enough to allow the development of some system of drainage, was never large enough to develop a stream of any

great size. None of the tributaries of the river, either from the north or the south, flow through regions more recent than the Carboniferous, with the exception of the lower parts of the Ohio itself and of the Tennessee, which border on the Quaternary. The lowest formation in the valley is the Cincinnati, which is just touched at a single point, and only for a short distance, about twenty miles above the city.

It may be stated, then, that since the close of Carboniferous time the river has flowed mainly in the same channel. The vast antiquity of the river is thus easily established, and the existence of the wide valley, with its broad bottom lands, is readily accounted for. The story of the river during the long period of pre-glacial time would be simple. For ages its waters were probably poured directly into the Gulf of Mexico, an arm of which extended northward into the continent at least as far as the present site of Cairo, Illinois. In later time the Mississippi-Missouri began the formation of a delta, which, gradually extending, has left the Ohio a tributary merely of the mighty "Father of Waters." As ages passed away it smoothed its rocky bed, and cut deeper and deeper between the hills, until at last there came a time in the history of the earth which man has called the "Glacial period." It was an age of intense cold—when a mantle of ice and snow covered all the New England States, New York, part of Pennsylvania, of Ohio, of Indiana, and Illinois, and thence extended northwestward to Dakota and the Rocky Mountain region. When the period was at its height, and the maximum limit of the ice-sheet had been reached, the course of the Ohio River became seriously affected.

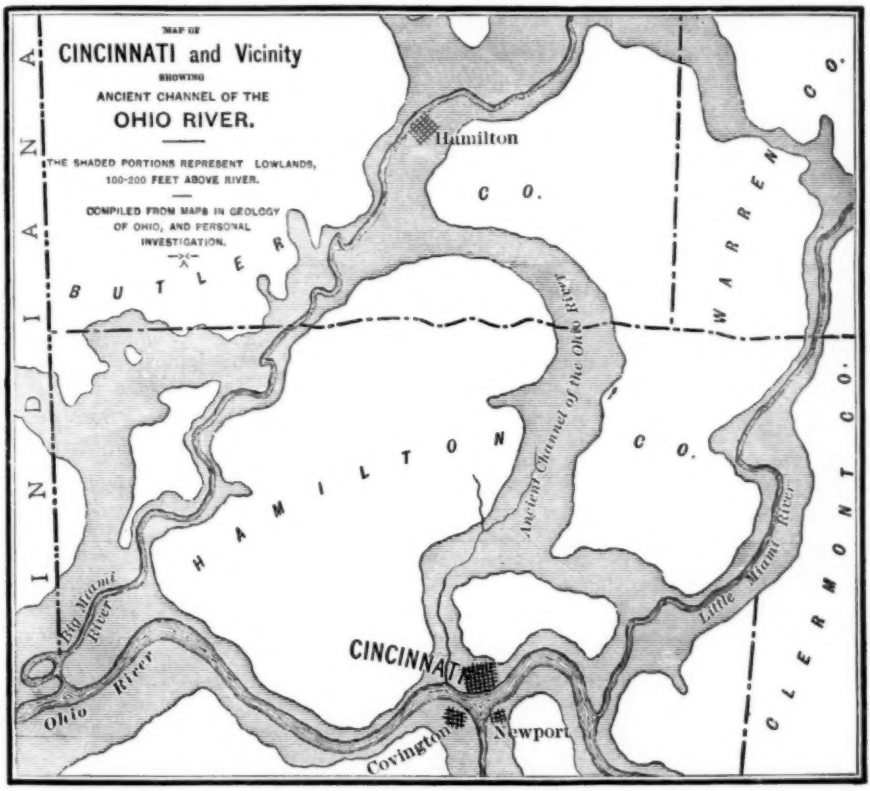
Profs. G. F. Wright and H. Carvill Lewis, Mr. Warren Upham and others, have shown that, at the period of the greatest extension of the ice, a portion of it crossed the Ohio River in the vicinity of Cincinnati, and extended southward for some miles into Kentucky. The course of the river as it now exists was blocked for a distance of probably fifty miles, or from near Point Pleasant, twenty miles above Cincinnati, to the mouth of the Big Miami, thirty miles below.

Investigations into the topography and surface geology of the region about Cincinnati reveal the existence of an ancient channel of the Ohio which divided into two branches.* One was on the eastern, the other on the western side of the city, and the two united just north of the city and continued to Hamilton, twenty-five miles. Here the old stream was joined by what is now the Big Miami, and the united rivers then turned southwestward and

* See a paper by the writer in the Journal of the Cincinnati Society of Natural History, vol. xi, pp. 96–101.

entered the present channel of the Ohio near Lawrenceburg, Indiana.

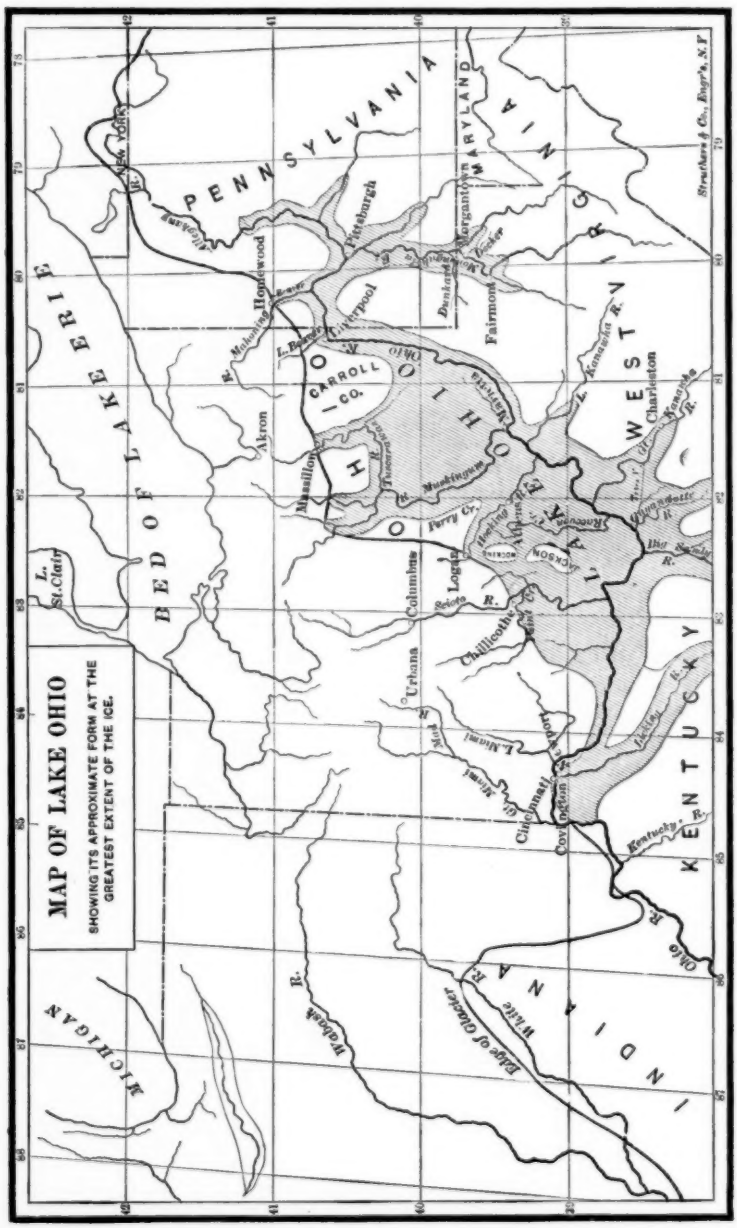
At the present time the Ohio passes by the city of Cincinnati and follows a channel cut between the hills at a more recent period than the greater portion of its bed. At the time of the existence of the old valley extending north from Cincinnati, a barrier of land extended across from Ohio to Kentucky and barred the way of the river to the west. This was cut down probably



at the time the country was occupied by the glaciers, and as a result we find in the present bed of the stream immense banks of coarse gravel alternately on the Kentucky and on the Ohio side for some miles below Cincinnati, while near the mouth of the Big Miami is another immense deposit which resulted from the melting of the glaciers as they retired northward up that valley.

The consequences of the stoppage of the current of the river are plainly seen. The glaciers creeping down from the north would naturally follow the old channel of the river and prevent its egress to the north, so it was probably during the on-coming

of the glaciers that the river began the task of cutting a new channel for itself—the one it now occupies; but when the ice reached and crossed the channel and entered Kentucky, this partly



MAP SHOWING THE EFFECT OF THE GLACIAL DAM AT CINCINNATI (Claypole). (From Transactions of the Edinburgh Geological Society.)

made new way was likewise obstructed. As a result the water rose higher and higher, backing farther and farther up its valley, until its estimated depth varied from three hundred to six hundred feet.

The investigation of this matter was made the subject of a special paper by Prof. E. W. Claypole, and from his pamphlet we glean some interesting facts.

Lake Ohio, as this body of water produced by the ice-dam was called, extended four hundred miles up the valley and was in places two hundred miles broad. Its waters covered the present site of Pittsburg to a depth of three hundred feet. Backing up the Monongahela River, it carved the terraces already mentioned, so that these represent the shores of this ancient lake in the mountains of Pennsylvania. Its northern boundary was formed partly by the ice wall itself and partly by the irregular outline of the high land it could not overflow. A few isolated patches projected as islands above its surface. On the south, long fiords existed in place of the former tributaries, and from the lower end of one of these was the probable outlet for the water. This, however, is still a mooted question, and though it is probable that much found its way through a low pass in the water-shed between the valleys of the Licking and the Kentucky Rivers, it is also likely that a part followed the foot of the ice and reached the Ohio Valley again some thirty or forty miles below the present site of Cincinnati.

How long Lake Ohio was in existence it is, of course, impossible to say. Various facts, however, indicate a life of many hundreds, perhaps thousands of years. So long as the dam existed, Lake Ohio held its own; but, when the ice began its retreat, the fate of the lake was sealed. As year after year the foundations of the dam were weakened, the pressure of the water was with greater and greater difficulty withstood. The heat of summer sapped its strength, but this was again renewed by the winter's cold; but, when the cold of winter was insufficient to supply the waste of summer, the end was really at hand. As Prof. Claypole says: "Possibly the change was gradual and the dam and the lake went gently down together. Possibly, but not probably, this was the case. Far more likely is it that the melting was rapid and that it sapped the strength of the dam faster than it lowered the water. This will be more probable when we consider the immense area to be drained. The catastrophe was then inevitable—the dam broke, and all the accumulated water of Lake Ohio was poured through the gap. Days and even weeks must have passed before it was all gone; but at last its bed was dry. The upper Ohio Valley was free from water, and Lake Ohio had passed away." *

This conflict of ice and water must have been frequently repeated, for the cold of winter would have repaired the damage of the summer; so that year after year, for how long one can not tell, the conflict was renewed. Says Prof. Claypole: "This

* Lake Age in Ohio, p. 16.

period of conflict between the ice and the river must have been a terrible time for the lower Ohio Valley and its inhabitants. At times the river was dry, and at others bank-full and overflowing. The frost of winter by lessening the supply, and the ice-tongue by forming a dam, combined to hold back the water. The sun of summer, by melting the dam, and the pressure of the accumulated water, by bursting it, combined to let off at once the whole of the retained store. Terrible floods of water and ice, laden with stones, gravel, and sand, must have poured down the river, and have swept everything away in their path—trees, animals, and man, if present. . . . To the human dwellers in the Ohio Valley—for we have reason to believe that the valley was in that day tenanted by man—these floods must have proved disastrous in the extreme. It is scarcely likely that they were often forecast. The whole population of the bottom lands must have been repeatedly swept away; and it is far from being unlikely that in these and other similar catastrophes in different parts of the world, which characterized certain stages in the Glacial era, will be found the far-off basis on which rest those traditions of a flood that are found among almost all savage nations, especially in the north temperate zone."

So there finally came a time when the Ohio Valley was no longer blocked by ice. But, when this time came, the *débris* from the melting glaciers had filled up the previously northward trending channel, while the long-continued floods had cut a new channel along the southern border of the ice as far as the mouth of the Big Miami. Thus was its ancient bed deserted forever, and was left to be occupied by insignificant streams, or else remained high and dry above the reach of any flood of future years.

The city of Louisville stands upon a deserted portion of the Ohio River channel also. It is in front of this city that the celebrated Falls of the Ohio are found. Here the river rushes over a rocky bottom, of itself indicative of a new channel, while on either side are wide stretches of sand or gravel, or low-lying plains through which the river formerly flowed. A late writer in one of the scientific magazines * states that evidence points to the fact that in pre-glacial times the Ohio River divided above the city, one branch flowing on the north and another on the south of an island, the two uniting again below the city. Well-borings show the rock in some places to be one hundred and fifty feet or more below the present surface, and what are now insignificant streams were once large enough to carve valleys half a mile wide and many feet in depth. Where was once the island, are now the falls. The ancient channels are filled with *débris*, and the new channel is a shallow rock cut, excavated since the close of the great Ice age.

* John Bryson, in American Geologist, March, 1890.

A physical history of the Ohio River would not be complete without a mention of the great variation in volume it presents, and some mention of the probable causes. Nothing is definitely known of its fluctuations during the prehistoric period, or indeed previous to 1832. It is true there are traditions of great floods in the river as far back as 1774. In 1787 there was a flood which some authors state reached one hundred and twelve feet. In 1792 there was another, reaching the height of sixty feet. The flood of 1832, of which there is authentic record, attained a height of sixty-four feet three inches. There were, up to 1883, twelve floods which reached or exceeded fifty feet. In that year (1883) the water reached a height of sixty-six feet four inches; and this was exceeded the following year by a volume of water which marked upon the gauge at the Cincinnati Water-Works seventy-one feet, three fourths of an inch. During the year 1890 the water twice reached a depth exceeding fifty feet.

Contrast these great floods with the extreme low water sometimes experienced. Five times during fifty years has the water sunk so low as to leave but three feet in the channel. The lowest ever known was in September, 1881, when the records show that twenty-three inches of water were found where three years later there were seventy-one feet. In October, 1887, it was also very low, there then being but two feet eight inches in the channel. At that time the river in front of Cincinnati showed its hidden dangers as scarcely ever before. A boy four feet high might have waded across without wetting his suspender-buttons. "Ugly-looking black bowlders, long, narrow, jagged reefs of moss- and slime-covered rocks and hillocks of gravel uplift their heads three, four, and five feet above the surface of the stream, all along the channel between the railroad and suspension bridges, while the big bar at the mouth of the Licking thrusts itself sheer across the river to within a hundred feet of the Ohio edge, at the foot of Walnut Street. One pebbled and coal-strewn reef, between Walnut and Vine Streets, is exposed for over two hundred feet, and it can be reached by wading from either shore. A sunken barge, which for years has been concealed from sight by the waters, is now wholly exposed, and its skeleton is visible from keel to gunwales, and stem to stern." *

The cause of such fluctuations is not far to seek. The destruction of forests about the head-waters of the tributaries, large and small, prevents the conservation of the water which falls in a rainy season. It rushes in torrents down the denuded hills and mountains, and is gone in a few days. A smaller amount of rain than the average, and the river becomes abnormally low. Abundant precipitation, on the other hand, combined with such con-

* Local paper, October 27, 1887.

ditions as cause heavy snows to be melted suddenly, together with the absence of forests which tend to absorb moisture and to give it out but slowly, produce disastrous floods, such as have so frequently occurred. That there is any effectual remedy for the floods can scarcely be maintained; that their violence can be mitigated, the adherents of reforesting devoutly believe; and that the great dearth of water can be largely prevented by allowing the hills to become clothed again with forests, and the springs give out their stores perennially instead of drying up in seasons of drought, all must admit. But the problems of a great river are not worked out in a few years, any more than its own history has been. Time is necessary for all things. We firmly believe that man will in the end find a cure for the evils of drought and flood to which the mighty Ohio has been subject since civilized man has planted himself upon her hilly shores.

STREET-CLEANING IN LARGE CITIES.

By General EMMONS CLARK.

ALTHOUGH it is an unquestionable fact that cleanliness of the streets is necessary to the health and comfort of the people, few, if any, of the large American cities have as yet satisfactorily accomplished this important sanitary object. European cities have generally been more successful in this particular, and their success is due mainly to their earlier attention to sanitary subjects, to their more arbitrary methods of enforcing police and sanitary regulations, and to the comparative absence of political and personal influences in their municipal governments. A difference is noticeable in the cleanliness of the streets of American cities, which may be attributed to the great disparity in the character and condition of their population, and the variety of plans upon which the streets are laid out, and the building blocks or squares are constructed. In those cities and parts of cities where the people of the laboring class and the poor are crowded in tenement-houses, and where a considerable part of the population is foreign-born and from countries where personal and public cleanliness have not been enforced by proper police regulations, it is no trifling task to secure cleanliness of the streets; but this desirable result is obtainable with comparative ease in those cities whose founders provided lanes or alleys in the rear of all dwellings, through which house refuse can be removed without any use of the public streets except for its transportation in carts to places of deposit.

New York, from its insular position, from its large foreign-

born population, from the crowded condition of a considerable part of its people in tenement-houses, and from its peculiar street and block construction, whereby it is necessary to remove ashes, garbage, and house refuse through a front entrance to carts in the public street, affords an example of the worst possible conditions for street cleanliness. But the more fortunate towns are not entirely exempt from the difficulties and embarrassments which have for a long period surrounded this subject in New York; and, although they may be interested in a less degree in the solution of this great sanitary and social problem, it will be observed that the history of street-cleaning in New York during the past twenty-five years is not uninstructive, and that the improved methods necessary in the metropolis are more or less applicable to all large American cities.

During the past twenty-five years the people of New York have earnestly demanded cleanliness of the streets; the press has echoed public opinion by a vigorous censure of the officials responsible for their filthy condition, and the sanitary authorities have urged from time to time an improvement in this part of the municipal service, as necessary to the public health and comfort. When the Metropolitan Board of Health was organized in March, 1866, it inherited from the city inspector the duty of enforcing an existing contract for cleaning the streets and removing the ashes and garbage of the city. The board made an earnest effort to perform its duty; charges of inefficient and unsatisfactory service and breach of contract were frequently made against the contractors; voluminous testimony was taken and counsel were heard, but without the desired results. In answer to the testimony of sanitary inspectors as to the condition of the streets, the contractors were always able to produce abundant evidence from their employés that the streets had been thoroughly cleaned in accordance with the provisions of their contract; and they also claimed that any just cause of complaint was due to the non-enforcement by the police of the laws and sanitary ordinances designed, directly or indirectly, to aid and facilitate their important work.

The hearings of the street-cleaning contractors by the Metropolitan Board of Health demonstrated that cleanliness of the streets is comparative and relative, and a subject upon which men entertain different opinions. A dwelling which a good housewife declares is filthy and intolerable, another housekeeper, less tidy, industrious, and exacting, will pronounce cleanly and satisfactory; so the contractors insisted that the streets of New York were clean, or "thoroughly cleaned," while the board and its officers were firm in the belief that they were dirty, detrimental to health, and discreditable to the city. It was also demonstrated

at these hearings that it is hardly possible to draw a contract that will secure clean streets without giving entire and unquestionable power to the city authorities to revoke and cancel the same at pleasure, and that with such a condition no responsible contractor would undertake the work and invest the large amount of money necessary for its performance. The importunity of the Board of Health, and its dissatisfaction with the condition of the streets, finally led to a sale of the street-cleaning contract to the Hon. James R. Whiting, a prominent leader in all movements for municipal reform at that period. Great hopes and expectations were entertained by all good citizens that New York would soon rejoice in clean streets, but they were doomed to disappointment, for no permanent improvement was visible. The opinion of all interested, officially or otherwise, was quite unanimous at last that street-cleaning by contract was a hopeless failure; and there was a general approval of the act of the Legislature of 1872, imposing temporarily upon the Police Department the duty of cleaning the streets and removing the ashes and garbage of the city.

The reasons for permanently conferring this power and duty upon the Police Department in the new city charter of 1873 were, first, that the commission was non-partisan, the two political parties being equally represented; and, second, that the department would strictly enforce the laws of the city and sanitary ordinances in respect to the streets and the care and disposal of ashes and garbage, and thereby remove an alleged cause of the failure of street-cleaning by contract. Although the Police Board was in one sense non-partisan, it soon appeared that both parties were clamoring for appointments and political patronage under the Bureau of Street-cleaning with a power and persistence almost irresistible and not always resisted. Nor was there any considerable improvement in the enforcement of the laws and sanitary ordinances in respect to the streets and the care and removal of ashes and garbage. The police force of New York, in physique, intelligence, and bravery, in the detection and prevention of crime, and in the protection of life and property, is certainly equal to any in the world; but for a proper and thorough enforcement of ordinances and regulations, trifling in detail but important in the aggregate, which concern and are necessary to the comfort of the people, it has never been distinguished. The streets of New York under the police *régime* were certainly as clean, and the removal of the ashes and garbage as well done, as at any previous or subsequent period, and at less expense; but the department did not satisfy the public or the press. A change was earnestly and imperatively demanded, and in 1881 the Legislature created a Department of Street-cleaning with a single head

and with ample power for its important purposes. Appropriations for this department have increased from year to year, until the enormous sum of $1,787,774.51 was estimated by the commissioner as necessary for the year 1891, and $1,584,250 was the amount appropriated; changes in the chief officers and employés have been made; various methods and devices have been adopted and tried; but the fact remains and is universally recognized that the streets are unclean. Some attribute their condition to insufficient appropriations; others to the inefficiency and incapacity of those intrusted with the work; others to political influences and to the use of its offices and appointments as political patronage; and others to the system and methods employed in conducting the details of the business. But, whatever the cause, the cry is universal, *Is there no remedy or relief?*

It is confidently asserted that none of the different plans proposed for cleaning the streets, nor an appropriation for that purpose double the present amount, nor a Commissioner of Street-cleaning of ideal business ability, fidelity, and integrity, can give New York clean streets, so long as householders and housekeepers sweep or throw their dust, dirt, ashes, garbage, or refuse, or any part of such material, into the streets, or allow anything to escape from their garbage receptacles upon the sidewalk or upon the street, nor so long as carts conveying dirt and refuse are allowed to drop any part of their contents on the streets. A walk in the principal streets and avenues from seven to nine o'clock in the morning will convince the observer that, whatever the shortcomings of the Street-cleaning Department, storekeepers and housekeepers are primarily and incidentally responsible for dirty streets by allowing their employés to sweep into the streets the dust of their houses or stores, and the dirt and refuse found upon the sidewalk. If the walk is extended to the tenement-house districts at any hour of the day, it will be noticed that it is quite the custom to throw ashes and garbage into the streets, and to allow these materials to escape into the street or upon the sidewalk from insufficient, improper, or overflowing receptacles. It will also be noticed that, soon after a street has been cleaned, it is again defiled by the refuse and garbage from the neighboring buildings, and that the carts which transport street dirt, ashes, and garbage, sand for new buildings, earth from cellar excavations, and the dust and dirt from buildings torn down, scatter some part of their contents into the street as they proceed to their destination. A student of the problem of street-cleaning has only to make the above observations to learn the primary cause of dirty streets in New York, and that, without a thorough reform in this particular, relief is well-nigh hopeless. This simple solution of the problem is only the application to the streets

of the familiar rules which govern every well-regulated household. Can a house be clean if the members of the family throw waste paper and other refuse on the floors, and ignore the waste-basket and the cuspidore; and how many times a day must the floors of the house be swept, if such a practice is tolerated?

It being absolutely necessary to the proper cleanliness of the streets that no dust, dirt, refuse, ashes, or garbage should be swept or thrown into the streets or upon the sidewalks, or allowed to escape thereon from ash and garbage receptacles or from carts, a thorough reform must be secured in this particular, and by the following means:

1. The education of the entire population of the city on this subject. All desire clean streets, and an appeal to the common sense and public spirit of the people will be successful. A plain and simple circular from an official source should be placed in the hands of each householder and storekeeper, and of each family in tenement-houses, to the effect that every particle of dust, dirt, ashes, garbage, and refuse should be placed in the garbage receptacles, and that the sidewalk should not be swept into the street, but the dust and paper thereon should be carefully gathered and placed in the garbage receptacles of the stores or houses. Such a circular would be disregarded by some, and all such should be personally warned by an officer of police against the continuance of the practice. Owners of carts conveying dirt, ashes, garbage, manure, or any refuse, should be notified that their carts must be absolutely tight and properly covered, and that the escape into the street of any part of the contents, however trifling, is a violation of the sanitary ordinances, which will be officially noticed by the police. In a very few months the people would thoroughly understand the importance of this subject, and few would overlook or violate regulations so reasonable and proper.

2. When proper notice and warning fail to prevent throwing, sweeping, or allowing the escape into the streets or upon the sidewalk of any dirt, ashes, garbage, or other refuse, the vigorous enforcement of proper sanitary ordinances becomes necessary. It should be made a part of the duty of every police officer on patrol to arrest any one violating such ordinances, and to ascertain who is guilty of any violation in the absence of an officer; and, for any neglect of such duty, officers should be held to as rigid accountability by their superiors as for failure to arrest or detect offenders against the laws concerning life and property. In many European cities the police are so active and vigilant in enforcing sanitary laws and ordinances of this character that the streets are models of cleanliness, and their condition materially promotes the health, comfort, and happiness of the people. To make the action of the police effective, the hearty co-operation of the courts

is necessary, and police justices must promptly punish offenders against the cleanliness of the streets, and severely, too, in case they are repeated. With proper action and co-operation of police officers and police justices, the great and most important obstacle to clean streets in New York can be removed.

When this is accomplished, the following will be necessary to entirely secure the desired object:

1. The laws and sanitary ordinances should be amplified and extended, if necessary, to cover minutely all subjects incidental and necessary to clean streets. Such laws and ordinances should be so broad, plain, and explicit that every citizen would know his duty in the premises, that every police officer would be certain when it was proper to make an arrest for violations, and that no police justice could fail to punish upon proper evidence.

2. The ash and garbage receptacles, in which the refuse of buildings and the sweepings from the sidewalk should be carefully placed, should be well made of galvanized iron, of style and size prescribed by ordinance, and they should be portable, absolutely tight, with covers, and the covers should not be removed except when necessary. These receptacles should be placed for removal in the areas within the stoop lines, or in some other convenient place, but never on the sidewalks; and rag-pickers and scavengers should not be allowed to disturb their contents. The ashes and garbage should be removed daily at a fixed and regular hour from every building, in absolutely tight carts, of size and style prescribed by ordinance, with covers so arranged that no part of the contents can escape. Carts for the transportation of street or cellar dirt, manure or other refuse, should also be of uniform size and style, tight and covered, and specially constructed and adapted to their respective purposes.

Public cremation of garbage, or its utilization by some of the known methods, should be introduced in New York without delay. Proper buildings for this purpose should be constructed upon the water front, conveniently located in different parts of the city. In many cities in this country the different processes are used for this purpose with satisfactory results. It is several years since the New York Board of Health demonstrated that refuse animal matter could be safely and inoffensively utilized within the city limits, and the metropolis should not be last to avail itself of improved methods for disposing of its garbage. When arrangements are made for the public cremation or utilization of garbage, the ashes and garbage should be placed in separate receptacles, and should be removed separately, the ashes being disposed of for filling sunken lots, redeeming marshy ground, and making new land in the city and vicinity. For a long period in the future, street dirt, and ashes free from garbage, will be

demanded for these purposes; the expense of removal would be trifling, and possibly at times could be done without cost to the city; and the improvements made by this means would abate the serious nuisances caused by stagnant water, and by wet and marshy lands, and add to the taxable property of the city. The harbor of New York would also be relieved from the dangers incident to the dumping of ashes and garbage in the neighboring waters, and the adjacent shores would be spared from the offensive nuisance caused by such a primitive and obnoxious practice. The removal and disposal of ashes and garbage should be done by contract, as the details of the work can be minutely specified. As a general rule, municipal work should be done by contract, as the direct employment of men by public officials, and the ownership of carts, horses, and stables by the corporation, are likely to lead, directly or indirectly, to abuses, personal or political, and private enterprise can satisfactorily accomplish nearly all public work at reduced expense to the city.

3. The city should be divided into districts of such size that one man would be able to sweep the streets of his district and keep them clean at all times. Nothing being swept or thrown into the street, one man would be able to keep in good order a considerable territory. To every twenty-five or thirty districts there should be an inspector or foreman, to note the service of the men, their efficiency, capacity, and faithfulness, and the character and result of their work. To these inspectors or foremen the sweepers in charge of districts should be directly responsible for the cleanly condition of the streets in their respective territories, and the inspectors should be responsible to a general superintendent under the Commissioner of Street-cleaning. The inspectors, as well as the sweepers, should be known to the citizens of their districts by a badge or uniform; and they should aid the police, by information and otherwise, in the enforcement of the laws and ordinances relating to the streets and their cleanliness. The inspectors should be men of the discretion and executive capacity necessary to their office; and the sweepers should be able-bodied, industrious, and temperate men, their qualifications to be tested by a fair trial, and their places secure during good service and behavior. Both inspectors and sweepers should be paid by the month, thereby elevating their respective positions above that of the day laborer, and making this employment desirable on account of its continuity and permanence.

4. The cleaning of streets and the removal of ashes and garbage should be conducted on strictly business principles, and can never be successful or satisfactory unless exempted from personal and political influences. The commissioner at the head of the department and all officers and employés, including street-

sweepers in charge of districts, should be selected solely because of their fitness for their respective duties, and should not be removed except for good and sufficient cause. The methods of the successful merchant, banker, and manufacturer, especially in respect to all employés, are necessary to the economical and satisfactory conduct of any public business; and whoever attempts to clean the streets of New York by any other theory or practice is certain to add another to the many notable failures of the past twenty-five years.

It is believed that with the adoption of the measures and methods above indicated, and strict adherence to the same, with fair executive business ability at the head of the Department of Street-cleaning, the streets of New York can be made as clean as those of London, Paris, or Berlin. From the city statistics it appears that the expense of cleaning the streets and removing the ashes and garbage of the city has increased more rapidly than the population, and that the expense was considerably less comparatively while the business was conducted by the Police Department than at any time since. As there has been no appreciable improvement in the condition of the streets in respect to cleanliness, it may fairly be concluded that the increased appropriations have not produced correspondingly improved results. It is also a reasonable conclusion that, with the exercise and use of business and common-sense methods, the entire cost of keeping the streets of New York clean, and carefully and satisfactorily disposing of its ashes and garbage, should not for a long period exceed the average appropriation of the last five years.

TRAINING FOR CHARACTER.

By Prof. HENRI MARION.

I PURPOSE to study now the movements of the child at the earliest age, and on the present occasion, particularly, the appearance and first steps of the growth of the will. In previous lectures we have witnessed the awakening of emotions in the child.* We have seen its perceptive faculties developing, new

* This lecture is a part of M. Marion's course on the science of education, delivered at the Literary Faculty of Paris. The lecturer's special subject in 1889 was the psychology of the child, and the present lecture was the tenth of the year. Having in previous years treated of education in general, its objects and means, of the great biological, psychological, and moral laws which rule in it, and of the great departments comprehended in it, M. Marion finally comes to the connected subject of the psychical development of the child, attending first to the description of it as it takes place in fact and spontaneously, but pointing out, as he goes, what it ought to be, how it should be directed, and how it is often disturbed.

and more complex sensations gradually modifying its simple and ingenuous egoism; and sympathy appearing and rising out of self-love, and transforming it as would a ferment. The child's social nature breaks out long before the end of the first year; it begins by beaming on the nurse and the mother, and then the child smiles at all pleasant and kindly faces. Play, which begins from this time to hold a large place in its life, appears to us in its origin as an essentially social pleasure. At the same time with the affectionate feelings we see arise those of a contrary character, like jealousy, which St. Augustine fixed in the sixth month.

Feelings and passions of a higher order are attributed by some writers to children of this age—the taste for the beautiful, for example. Some would give it to the child at the breast, with reason, if infants' admiration for bright lights and vivid colors is a taste for the beautiful. While this tendency is common to children with many animals, we have a right to see in it a nascent æsthetic feeling. M. Victor Egger has described a case of musical enthusiasm in a child less than six months old. "Lying on a bed, its nurse having already excited it by playing with it, the Marseillaise was sung to it (in a man's voice). It listened, looked up, with throbbing mouth and throat, throwing its arms out from time to time. In the midst of the song it uttered a single sharp cry that almost frightened us. During all this time it exhibited an intense, joyous emotion, but too deep for infantine joy. It might be said that it put itself in unison with what it heard. The song was not repeated. The child's excitement was too great." Whether enthusiasm or not, there was certainly more than a simple sensation in the emotion thus described. It is very certain that a child of that age should be spared such an intoxication, which could not be repeated many times without grave prejudice to the firmness of its nerves and its psychical equilibrium.

I have not perceived at the period we are considering anything resembling the moral feeling which Mr. Darwin and M. B. Perez believe they have found in the nursling; it appears later, largely as a fruit of education. Associations of agreeable or disagreeable ideas which the infant is susceptible of from its first months should not be confounded with rational feelings, like those of order and justice and right and duty.

The movements are next to receive our attention; they are the only possible signs of what is going on in the child. Its affective sensations, its representative sensations, its feelings—all the phenomena of its psychic life which we have so far studied—are apparent to us only through their motive manifestations. But what we have been able to say in passing of such and such movements as expressions of consciousness is not enough. The motions deserve a special study in themselves and for themselves, in view

of their psychological significance, which is immense, especially when it is considered in connection with their intimate relation to voluntary energy. We shall consider, first, in general, the psychological value of the movements. It has already been thought worthy of remark that movements, or muscular contractions, translate the interior life and give it outward radiance. The obscurity of the fact is relieved if we suppose, with contemporary physiology, that thoughts and feelings, as facts of consciousness, while not undoubtedly reducible to simple movements, are nevertheless based on incipient or asserted movements. On the other hand, M. Féré has shown that all sensation is accompanied by an augmentation or disengagement of muscular force. The force and quality of motive manifestations are undeniably signs of psychical dispositions, either permanent or accidental. We all know that a weak and indecisive step, halting speech, slowness in eating, the physical tendency to dawdle and take twice as long as it needs to do anything, betray in children a general mental, corresponding with the organic inertness. The quality of the habitual motions, as revealed by the attitude, the walk, the play of the features, and the writing are certain signs of the character. While we may be mistaken through inexperience or want of attention, or of method in the interpretation of them, their value to a skilled observer can not be disputed.

Motion, strong, various, fruitful, which delights in itself and enjoys the effort it calls out, is agreeable when there is a superabundance of life, when it sets to work reserves of energy which it has not exhausted. The diversities of our tastes come in a large degree from this. What is beyond the capacity of some, and seems impossible or insupportable to them, charms others, and seems like play to them. There is a profound analogy between being fond of action and the physical, and having movement in the mind and force in the character; but it does not extend to identity.

Besides interpreting the moral condition, motions act upon it in return. This reciprocal influence of movements on states of consciousness is another law of general psychology, of which education should not lose sight for an instant. Not only do what we feel, think, and wish determine our motions and acts, but, inversely, the motions and acts which become habitual, even those which were involuntary in the beginning, determine, to a greater or less extent, in time our ways of feeling, thinking, and wishing. The recurrent action of attitudes, gestures, and acts on the moral condition was pointed out long since by physiognomy. The fact, now trite, that, by giving a certain position to the limbs of a hypnotized person, we put him into a corresponding psychical state, is only an extreme case of this law.

The plasticity of the child is hardly less. By causing it to perform a certain motion and habitually preventing it from making the opposite one, we act in a wonderful degree on its feelings and ideas. Is not making it talk, eat, and move in a more lively way a means of shaking off the inertness of which we just spoke? Hence the possibility of that moral training, which should not be confounded with moral education proper, for it is in one sense the opposite, but which is, nevertheless, not unrelated to it; for there is mechanism, one part of training, at the beginning in all education. It is thus important to study the motions of the little child—first, in order to interpret them correctly as signs, and thereby to read in its consciousness; and, second, to know how to regulate them practically, to favor or repress them according to circumstances, and in this way to act upon the child's character. Let us try, then, to retrace in outline the progress of the faculty of motion in the child till it learns how to walk, dwelling preferably upon the movements the more direct relation of which with the will gives them a special importance. The general truth prevails through the whole subject that motions which become voluntary begin by not being so; that intentional activity, the nascent will, does but gain possession of acts which were at first not willed. We are about to inquire how this takes place.

Involuntary motions appear to be of four kinds—automatic, reflex, instinctive, and imitative. The motions which I call automatic are not inspired or guided by any representation, but proceed exclusively from the energy accumulated from nutrition in the nervous centers. They occur when that energy is disengaged outwardly by the motor nerves without peripheric excitation of the sensitive nerves, and of course without a mental representation, of which the subject is not yet capable. These uncoördinated movements, including motions before and just after birth, the first motions of the eyelids, eyes, hands, arms, and legs, and all sorts of grimaces, have in themselves but little psychological interest; but they are the ones of which the will gains the most complete possession. The more indeterminate and characterless they are in their origin, the more conscious energy, awaking in them, will be able to make them its own. The case is different with the motions of the next two categories; regulated and limited by nature, the will will never absolutely dispose of them or resist them without difficulty. It would be no small effort for it to prevent reflex actions and contend against the instincts.

The reflexes are motions which are produced instantaneously and mechanically after certain peripheral impressions; of such is sneezing, the first act of the infant in coming into the world, and coughing. Although they fall more or less under consciousness, in that it is informed of them as they occur or immediately after-

ward, they are not produced by mental representations, nor are they in any degree at first dependent on the will. By its inevitable and mechanical character, the reflex is the contrary of the voluntary act. Yet we may say that it also is after its way a kind of matter for the will. One of the first exercises imposed by education, one of its most laborious apprenticeships, is to control the reflexes and prevent their being produced. Except for the little that the will may gain upon them, or rather upon the conditions under which they are produced, the reflexes remain substantially the same through life, with the difference, which Preyer seems to have well established, that they are slower in the new-born child than they afterward become.

The instinctive motions resemble the reflexes; they have to a certain point their mechanical character, and are produced only as in consequence of certain determined impressions. Thus, the young chick does not perform the motion of scratching on the carpet, but begins it at once on the gravel walk, as if the feeling of grains of sand was necessary and enough to set the mechanism in motion. But there is a great difference between instinct and the reflex; it is not only that instinct is more complicated and its complex motion is composed of co-ordinated movements; but it is connected with a mental disposition, and is dependent on a psychical representation and tendency, or an image and a feeling.

Some philosophers, reserving the name of instinct for the remarkable industries of some species of animals, like bees and the beaver, deny that man has instincts. But how can we dispute that true and indestructible instincts preside over the functions by which individual life and the life of the species are preserved? The truth is that, while instinct is all with certain animals, with others, more perfectible and higher in the scale by that fact, a very large part is left to the intelligent activity that can adapt itself to circumstances. This is at the maximum in man; and in the adult and cultivated man of the higher races the part of mechanism is reduced very nearly to nothing. But in the child instinct exercises all its rights, till education deranges and modifies it. The instinctive character—that is, partly psychical and not purely reflexive—of the movements composing the action of sucking, appears by the fact that the hungry child will suck at his finger as well as at the breast, while, if he is not hungry, he will refuse even the breast. It is also by instinct that he laughs when we excite him by playing with him, or even by tickling him, for, if he is in a bad humor or a stranger tries the experiment, he may cry instead of laugh. The instinctive reaction depends essentially on the psychic condition at the moment. Nevertheless, this does not prevent instinct being a hereditary mechanism, over which the

will has directly very little influence. It can affect it only by disposing at its desire, when it can, the circumstances that call the instinct into exercise.

Till the end of four months, I believe, the child makes no motions that are not automatic, reflexive, or instinctive. From the fifth month, perhaps, certainly in the sixth and seventh months, imitative motions appear, the nature of which is obscure, but which are of signal importance in the point of view of psychogenesis and education. It is hardly necessary to say that I am speaking of unconscious motions instinctively imitated, not of conscious and voluntary imitation, which will come much later.

Preyer seems to me to be under a mistake when he supposes imitation to be essentially voluntary. To my mind there is no will without an expressed intention. Where is the intention, the reflecting consciousness, when an infant, hearing another one crying, begins to cry by contagion, or when a child of seven months, seeing me tapping the table or the window with my fingers, executes a poorly imitative scratching with his fingers? Nurses teach children at this age to say good-by with a motion of the hand, which their wards imitate at sight. I was recently told of a boy twelve months old on a railway train, who, when his father, to quiet him, snapped his fingers in his face, immediately imitated the motion, to the surprise of all. Rubbing my hands one day at the table, partly because of the cold, partly in idleness, I saw a little girl three years old stop eating to rub her hands too. The same child, when twenty months old, seeing an image of a crying child, by an unconscious imitation opened her own mouth. Children laugh when they see people laughing, yawn, sing, cough, spit, snuff the candle, light a paper at the fire, and pretend to read and write, long before they comprehend any of those acts. One of their greatest pleasures is to imitate the cries of animals, either spontaneously or after another. Their plays are nearly all imitations of adult life. When they hear a story that engages them, we can see them taking on, one after another, the expressions of the characters; and when they begin to speak, they repeat all they hear, including oaths and other bad words, which it horrifies us to hear from them. It is hardly correct to see in this aptitude of children to imitate a sign of inferiority, as Delaunay did. It is rather a promise of intelligence. What is called the child's docility results largely from these endowments. It learns everything, at first, by imitation—to speak, write, and sing. Unconscious imitation accounts for many facts—for the fact, among others, that in a family of several children the younger ones are often more advanced than their elders were at the same age. But this more than half animal plasticity is not really intelligence, although it announces it; and it is truly un-

fortunate if age comes upon one without giving him something better than this simian and parrot-like disposition.

These imitative motions, at first wholly involuntary, are the ones which the will will take hold of to make them its own or to suppress them. Habit, however, renders them indelible. Hence it is never too soon to watch against them. As Preyer well says, everything that could lead its imitative tendency into dangerous ways should be removed from the child. The first duty of education is to look after the surroundings of children, who can not grow up healthy except in a wholesome medium. To comprehend the weakness of the will against imitation re-enforced by habit, we have only to recollect the struggle we have had against the tendency to do what we have been accustomed to do. Usually reason accommodates itself to the situation. Anticipated and led on, it does what is easiest. It seeks, and always finds when it seeks, reasons in favor of inveterate acts, and invents sophisms to justify them.

Voluntary motions are the intentional ones, or those which depend essentially upon conscious thoughts and feelings, representations and emotions. The will appears at a relatively late stage of the general development, when the senses have furnished a rich provision of images and the consciousness of a considerable number of feelings. Not till then can there be at the same time the conception of various possible motions, foresight of what should result, comparison, preference, and choice, or a relatively clear acquiescence in certain acts to the exclusion of others.

There is no sign of will so long as the child performs only unconscious, automatic, reflexive, instinctive, or imitative motions independently of its previously acquired ideas and pre-existing affections. Will begins when a thought properly so called becomes motive in itself, or in the desire accompanying it; when a movement known to be possible is anticipated with its results, and is accomplished intentionally. Not that every detail of the matter is understood, for even adults are not thus acquainted with the inner mechanism of their movements; but it should be represented in advance, preconceived as a whole, and determined originally by the thought of the new that it will introduce into the consciousness of the subject. Observers seem agreed that there can be nothing of this kind before the fourth month. Will appears when the child, for example, associates the thought of an object to be taken with that of making a motion to take it. It is, as it were, revealed to itself when after awkward and fruitless attempts the child meets a sudden success, discovers his power, and gains confidence in himself. From this time on the will gathers force with the number of such associations as they are

more and more frequently repeated, and with the number of such efforts becoming more and more sure and successful.

The will presenting the double aspect of a choice between a number of possible acts and of ends to be sought, and of a conscious effort to use the means by which the object is to be reached, its growth is also double. It becomes more worthy of attention as the consciousness, growing richer in ideas and feelings, obtains a larger choice of ends and means, and as the active energy becomes capable of stronger and more consecutive effort.

As the faculty of voluntary motion is developed, movements which were at first fortuitous, unconscious, and ignorant of objects, executed without intentional direction or prevision, mechanically or upon chance impressions of the senses, are taken notice of, become gradually more closely associated with the perceptions, executed with increasing ease and accuracy, and more and more the effect of an express will or conscious energy, which knows what it is doing and does what it wants to. This energy, although it takes on a new name, does not invent a single new movement and creates nothing. The power of attention is an essential factor, perhaps the principal one, and makes of an energy in the beginning dispersed a concentrated and intentional energy. We can not determine to what point attention is at any age the condition of a rich mental and moral development. But when the child, having taken notice of its incoherent and awkward movements, begins the effort to co-ordinate them in view of precise ends; when, for example, it moves symmetrically both arms to embrace or both hands to take; when, inversely, it isolates movements formerly associated, stepping on one foot to push the ball with the other, striking with one hand the dish which it is holding in the other—it is already performing an act of the will.

There is a kind of struggle for existence among the thousand vague movements of the eyes, arms, hands, feet, and head. Those which are useless or injurious are eliminated. Those which are advantageous, that procure a physical or moral satisfaction, are repeated, predominate, and are accomplished in better style. From involuntary they become voluntary, while many, again, escape the will to become habitual. Preyer gives a minute description of the various motions of the child and their progress, which we can retrace daily in its general features, in the attitudes and motions of the head, for a long time directed very awkwardly, even in taking the breast; the motions of prehension, apparently more natural and often easier to the child than the act of letting go, when it has a hold; the gradual way in which it learns to sit down and remain seated, to creep, to get along on its knees, to rise upon its feet, to stand, to let go of the support, and to walk.

It is a law of some of the motions we are talking of that exercise perfects them; we can, therefore, to a certain degree, hasten their development. But we must be very careful how we do this, for every premature exercise is accompanied by dangers; all precocity is paid for in bad money. The precept, *follow Nature*, is especially pertinent in the earlier years. Then, more than ever, Nature takes her revenge if we try to hurry her and do violence to her. No artificial excitations. They are rarely necessary, and are dangerous.

People sometimes ask, At what age can we seat a child in a chair; when put him on his legs; how old must he be before we teach him to walk? The answers are easy. He must not be made to sit till he has spontaneously sat up in his bed and has been able to hold his seat. This sometimes happens in the sixth or seventh month, sometimes later. The sitting position is not without danger, even when he takes it himself; imposed prematurely upon him, it tires the backbone and may interfere with the growth, so the child should never be taught to stand or to walk. That is his affair, not ours. Place him on a carpet in a healthy room or in the open air, and let him play in freedom, roll, try to go ahead on his hands and feet, or go backward, which he will do more successfully at first, it all gradually strengthens and hardens him. Some day he will manage to get upon his knees, another day to go forward upon them, and then to raise himself up against the chairs. He thus learns to do all he can, as fast as he can, and no more.

But, they say, he will be longer in learning to walk if he is left to go on his knees or his hands and feet indefinitely. What difference does it make if, exploring the world in this way, he becomes acquainted with things, learns to estimate distances, strengthens his legs and back, prepares himself, in short, to walk better when he gets to walking? The important thing is, not whether he walks now or then; but that he learn to guide himself, to help himself, and to have confidence in himself. I hold, without exaggeration, that education of the character is going on at the same time with training in locomotion, and that the way one learns to walk is not without moral importance. From different points of view, but for reasons identical at the bottom, hygienists and moralists agree in disapproving of leading-strings. In a moral and physical sense, the pre-eminent educating agent is liberty, natural activity, unfolding itself without constraint under a discreet surveillance that is limited to removing grave changes and preventing real faults. The necessity of such surveillance is otherwise evident from the fact that the body of the child, on account of its extreme suppleness, takes every sort of wrinkle, if we may speak thus, with equal facility. Vigilance at every moment is all that can prevent it from contracting every kind of vicious

habit; the great point is to reconcile such vigilance with the liberty which its spontaneous development demands.

The progress of voluntary motions reaches its goal when they are willed, so to speak, in all their parts, going to their clearly conceived end by the simplest ways, with the greatest precision and accuracy. Then there is no more fortuitous or indeterminate motion, no more expenditure of useless force. Such a triumph of reflective activity may be observed, for example, in the accurate designer. Those know how much time and pains it takes to reach that point who, trying to teach children to write, have seen them at seven or eight, or more, years old, twist themselves, make faces, stick out their tongue, pucker their lips, and make ten useless movements to one useful one. This brings us back to the important fact that inhibition of noxious or useless acts, of automatic motions having no necessary relation to the willed act, is an essential element of the progress of mobility.

This is equally the case in the progress of the will generally. In morals, too, when the act consists as much in the inner resolution as in the motion that carries it out, while the will may begin by being a hardly conscious effort of desire tending toward its object, it will end by being to a large extent the contrary—or a conscious and intentional restraint, a spontaneous inhibition. I say spontaneous; but a long time will pass before the child becomes capable of controlling himself, of spontaneously resisting his impulses and desires; he will have to be helped in it at first.

It is the office of education to put the first check upon some of these impulses to the advantage of others, to oppose thought to thought, tendency to tendency, and fear to desire. That is why the subjection of children to a firm discipline is always the beginning of education. To resist them is to hold them up. To bend them to a rule, as broad as you please, but inflexible as to what it prohibits, to prevent their doing what ought not to be done, to exact from them only what is necessary, but exact it firmly, is to prepare them to govern themselves.

But, so far as the inhibition is not the child's own act, it is not an act of the will. It does not become that till after having been imposed often from without, and, having thereby become less painful, it is appreciated by the child itself for its results, and the will becomes the possessor of it. This is the reason that while the earliest discipline should be firm, it must nevertheless be broad and liberal, and become more and more so as the reasoning faculty is developed. I call broad and at the same time firm a discipline which, without yielding anything to caprice, or to the unregulated and tyrannical demands of the child, purposely avoids loading him down with prescriptions and prohibitions, and leaves him as much elbow-room as possible in order to accustom

him to frank action and the free exercise of his faculties under his own responsibility. It must not be forgotten that, while the inhibition imposed upon him is a means, voluntary inhibition is the end. The purpose is to initiate him into self-restraint and self-government, and he can be prepared for it only by being exercised in it.

Preyer is not quite clear in marking the distinction between not wishing and wishing not. We define two distinct species of inhibition; one voluntary, and the other really willful. The first takes place when a child under restraint and watch abstains against his own inclination from doing what is prohibited—for example, when he stops crying when interrupted by a stranger, or when in the garden he draws back from a trespass he is about to make upon the turf at the sight of the watchman. There is in those acts what may be called a simple non-wishing, for the thing that counteracts the temptation is something outside of the child's will. But when the child, free and alone, finds spontaneously in his own thoughts and feelings a counterpoise to his temptations, there occurs an inhibition of a new kind, which is not simply a non-will but a positive and meritorious will. Moral education consists essentially in gradually substituting this kind of inhibition for the other, the empire of reason for that of constraint.

It does not really begin so long as we only guard, watch, and prevent. Innocence thus obtained has only a provisional and preparatory value with the child, and none with adults. Some young people have been brought up in this way, under conditions of complete surveillance, kept in leading-strings till they were twenty years old. This is better than nothing, in so far as the object is to prevent their making fools of themselves; but their parents are mistaken if they believe they have been well trained; they have not been trained at all. They are like the cat that withholds its paw from the tempting dish as long as it sees the stick, but which is secretly eager to get its chin in.

That person alone is morally trained who can watch and conduct himself; who, as Montaigne says, "has enough in his own eyes to keep him in office." Education ought gradually to lead children to this point, prudently risking a little, loading them from the beginning with as few restraints as possible and loosening these little by little, making only reasonable demands and explaining the reasons for them as fast as they can be comprehended. I do not hesitate to measure the value of an education according to the degree in which it has sought to teach the child from the cradle to help himself and govern himself—to make men who shall be characters.—*Translated for The Popular Science Monthly from the Revue Scientifique.*

WHAT KEEPS THE BICYCLER UPRIGHT?*

By CHARLES B. WARRING, Ph. D.

THERE is something weird, almost uncanny, in the noiseless rush of the 'cyclist, as he comes into view, passes by, and disappears. Pedestrians and carriages are left behind. He yields only to the locomotive and to birds. The apparent ease and security of his movement excite our wonder. We have seen rope-walkers, and most of us have tried to walk on the top rail of a fence, and have a vivid recollection of the incessant tossing of arms and legs to keep our balance, and the assistance we got from a long stick or a stone held in our hands. But the 'cyclist gets no help. His legs move only in the tread of the wheel, and his hands rest quietly on the ends of the cross-bar of his machine. The rope-walker keeps every muscle tense, and every limb in motion or ready to move. No wonder, when a tourist on his bicycle spins for the first time through a village here, or among the nomads of Asia, he is followed by a gaping crowd, till his machine carries him out of their sight.

We involuntarily ask, How is it possible for one supported on so narrow a base to keep his seat so securely and, seemingly, so without effort?

For an answer to this question I have searched somewhat widely, and, while I have found articles enough on or about the bicycle, and what has been done by its riders, I have found none that offered a reasonable theory for its explanation. This is my apology for presenting the present paper. In it I shall state the theories which have been offered, the reasons why they are unsatisfactory, and then give what appears to me the true *rationale* of the machine.

The only paper I found that claimed to explain the bicycle was one by Mr. C. Vernon Boys, entitled The Bicycle and its Theory. It was delivered before a meeting of mechanical engineers, and is reported at great length in Nature, vol. xxix, page 478. Here, thought I, is something valuable and convincing. But, on examination, I found that, out of several pages of closely printed matter, the Theory occupied possibly a dozen lines. All the rest was about the bicycle and what had been done on it, but not another word about its theory. We are told that Mr. Boys exhibited a top in action, and requested his audience to notice its remarkable stability. Then he said that the stability of the bicycle was due to the same principle, but made no attempt to show any connection between them. The top revolves on its axis, and

* A paper read before the Vassar Brothers' Institute.

it stays up as you see; the wheel of the bicycle revolves on its axis, and therefore it stays up, was his theory and demonstration, and the whole of it, and, so far as one can judge from the report, he was satisfied, however it may have been with his audience.

Of all machines, none seem to be so little understood as the top and its near relation, the gyroscope. Hence the best that can be said is, that the lecturer availed himself of the tendency found in most minds to "explain" an unfamiliar phenomenon by referring it to some other more familiar one, longer known, but equally incomprehensible—as if, as in grammar, two negatives make an affirmative, so, in physics, two unknowns make a known.

Without going into the theory of the top, or of the gyroscope, it is easy to show experimentally that their stability and that of the bicycle must be due to different principles. I spin on the table before you a top with a somewhat blunt point (Fig. 1). You notice it runs around in a circular or rather a spiral path, and gradually rises to a perpendicular. I strike it quite a hard blow, but do not upset it. I send it flying across the table, or off to the floor, but still it maintains its upright position. You notice that, when it is perpendicular, it stands still; but, if it leans ever so little, it immediately begins to swing or gyrate around a vertical axis. I now change the top for one whose point is very fine and well centered and sharp (Fig. 2). You see that it hardly

FIG. 1.—BLUNT-POINTED TOP.

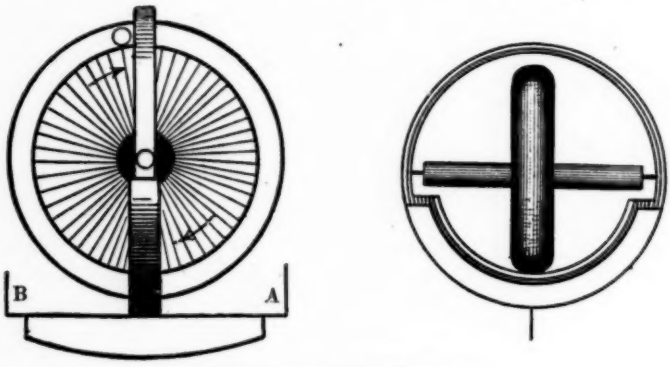
FIG. 2.—SHARP-POINTED TOP.

travels at all. I now cause the point to fall into a slight pit in the surface of the table: it ceases to travel, but continues for a very considerable time to swing around a vertical axis, and is remarkably stable, whatever the angle at which it leans. Stopping its traveling has, as you see, no effect upon its stability; but now I put my pencil before the axle and stop the gyration or swinging around. Immediately the power of staying up is gone, and the top falls. I may vary the experiment in every possible way: so long as the axis is inclined, the result is the same; the moment the gyration ceases, the top falls.

In the case of the bicycle there is no gyrating around a vertical axis. Whatever else it may do, it does not do that. Yet, as

you saw, gyration is absolutely essential to the effect which Mr. Boys thinks accounts for its stability.

We may, I think, dismiss the top from further consideration; but there is another instrument apparently much closer in its relation to the bicycle. I mean the gyroscope, or rather that form of it which Sir William Thomson calls a gyrostat. Its wheel is upright like the bicycle's (see Figs. 3 and 4). The lower part of



FIGS. 3 AND 4.—THE GYROSTAT.

the ring which supports the wheel rests in a kind of trough, to the bottom of which is attached crosswise a piece of metal (best seen in Fig. 3) curved on the lower edge, and with two projecting wires by which it may be drawn back and forth in the plane of the wheel.

I now set the wheel in rapid motion—much more rapid than any bicycle-wheel can go; I place it on a smooth, hard surface—I have here a pane of glass—and leave it to itself. It begins at once, as you see, to revolve around a vertical axis. If it leans little, it revolves slowly; if it leans much, it revolves faster. It will not fall to the table, though I push it, or strike a hard blow. It resists with remarkable force. I now take it by the projecting wires and attempt to make it move in a straight course, as a bicycle does when it spins along the road. Instantly it falls. The rotation of the wheel on its axis was not in the slightest degree interfered with, but the stability vanishes the moment the rotation around the vertical axis ceases. Invariably it falls. Yet you observe the conditions are far more favorable for the effect of gyrostatic action than in the bicycle, for the mass of the rim of our gyrostat is many times heavier in proportion to its size, and its speed incomparably greater. I try the experiment over and over, the result is always the same. No amount of skillful management will make the instrument stay up for an instant if it has to move in a straight line. I submit that these experiments are proof positive that the sustaining power of the bicycle does not come from any gyroscopic action.

Others find in its going so fast the reason why the bicycle does not fall—referring, of course, in a blind way to that principle embodied by Newton in his first law: "A body in motion, if left to itself, will continue to move in a straight line forever." A brief examination will, I think, convince you that this, too, fails to account for the effect which we know is somehow produced.

It is another principle in physics that two forces acting at right angles to each other do not interfere. Each produces its own effect as fully as if the other did not act. For example, if a certain force sends a body (D, Fig. 5) north at the rate of ten feet in a second, and another force sends it east at the same rate, at the end of one second it will have gone ten feet north and ten feet east, exactly as if each force had acted alone. Going toward A B does not in the least hinder its going toward B C. Now, in case of a bicyclist, his forward motion, whether fast or slow, is at right angles to gravity, hence does not in any way resist it; and, therefore, as it is gravity that causes him to tilt over, the forward motion will not prevent his falling.

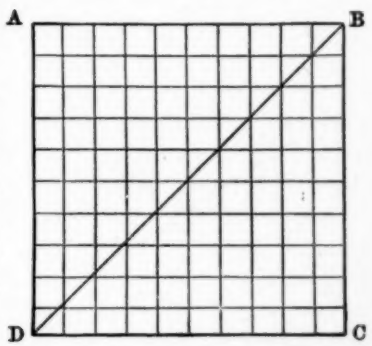


FIG. 5.—DIAGRAM ILLUSTRATING THE COMPOSITION OF FORCES.

But it may be said that the force of gravity when the 'cycle leans, say to the right, is in fact resolved into two components, one vertical and the other lateral, and it is the latter only that causes the bicyclist to fall. This does not help the matter, for both components are perpendicular to the course of the bicycle, and hence its forward motion can in no way counteract either of them. Unless some other force comes into play, the bicyclist must fall toward whichever side he happens to begin to lean.

Many think they find this counteracting influence in "centrifugal force." You all are familiar with the effects of this "force." You feel them every time you turn a corner quickly, whether on foot or in a wagon, or on horseback. The bare-back riders in the circus lean well toward the center of the ring, to escape being thrown outward. We see its effect when the bicyclist spins around a corner. In such cases "centrifugal force" plays an important part, and is the real upholding force.

But centrifugal force is impossible so long as the body moves in the same direction—i. e., in a straight line. There must be change of direction, and, other things being equal, this force is greater in proportion to the abruptness of that change; or, as mathematicians say, the velocity being constant, it varies inversely as the radius of the curve in which the body moves. The

larger the radius the smaller the centrifugal force. If the radius of curvature becomes infinite—i. e., the curve becomes a straight line—the centrifugal force becomes infinitely small, or zero.

So long, therefore, as the bicyclist does not turn corners—keeps in a straight course—the centrifugal force gives us no assistance whatever in understanding why he keeps his seat so securely. But yet it may be thought that this force, if supplemented by skillful balancing, is sufficient. It keeps the bicycle from falling when turning corners: will not good balancing account for the stability when moving in a straight course? We are all familiar with the phenomena of balancing one's self. We know the help a heavy pole gives at such times; how a person's legs and arms move with startling rapidity in the opposite direction to that in which he feels himself falling. There is nothing of this on the wheel. If the stability was due to balancing, it would not be so very difficult for a bicyclist to sit upon his machine when not in motion, and when its wheels both point in the same direction. I have never seen one that could do it. I suspect, however, that it is not impossible, any more than to stand on the top round of an unsupported ladder. But the ordinary bicyclist can not do it; and yet, without apparent effort, he rides securely. That his stability is not due to his balancing and to his rapid forward motion combined, is evident when we reflect that if the handles are made immovable, so that neither of the wheels can be turned to the right or left, it is impossible for any ordinary rider, no matter at what speed he may move, to keep from falling for any considerable time after he once begins to tilt.

Apparently the fact that some can ride "hands off" on a safety wheel contradicts this, for, however it may be on an "ordinary," on a "safety" the rider can not guide it by the pedals, and as he does not touch the handles of the steering-wheel or the wheel itself, it would seem that his not tilting must be due to good balancing. Experiment, however, proves the contrary. Let the steering-wheel be fixed by tying the handles, or by a clamp on the spindle, so that it can not turn to the right or the left, and then let the 'cyclist try to keep it erect. Balancing won't help, except possibly to delay his fall a few moments. And worse than that, he can't ride hands off at all if he tries to do so only by balancing. The explanation of such riding is not very difficult, but requires some other matters to be treated first. At present all I desire to establish is that in this kind of riding, as well as in all others, the rider's ability to keep from falling to one side for an indefinite time while traveling in a straight line is not due to balancing.

I think you will agree with me that the reasons thus far assigned for the stability of the bicycle cast little or no light

upon the subject. Gyration has nothing to do with it; centrifugal force has no application to it, except when turning corners, or otherwise changing abruptly the direction of the movement; balancing is a detriment rather than an assistance;* and rapid motion alone accounts for nothing. Some other explanation is needed; this I shall now attempt to give.

Regarded mathematically as a machine for the application of force, the bicycle is a very simple affair. The weight (Figs. 6 and 7) is applied at the saddle, A, and is so great that the center of

FIG. 6.—AN "ORDINARY" BICYCLE, WITH LINES OF FORCE.

gravity of the whole is very close to that point. A B and A C are the lines of force, B marking the point where the fore wheel rests on the ground, and C where the rear one. In discussing the forces that act on the machine we need consider only these lines, all the other parts being merely for convenience or ornament. It is evident that A can not of itself tilt either backward or forward, since a vertical line from it falls between B and C. In

* At the close of the reading of the paper, a teacher of the art of riding the bicycle, a man of large experience, arose, and, in the course of his remarks, said that one of the chief difficulties he had to contend with in teaching beginners to ride, was to induce them to give up all idea of balancing; that till this was done they could not ride well—a striking corroboration of the theoretical conclusion arrived at by the writer of this paper.

reference to them it is in stable equilibrium, while in regard to side motion its equilibrium is very unstable; the least thing will upset it.

To study the matter more conveniently, I have had a form made which eliminates all unnecessary parts and represents only

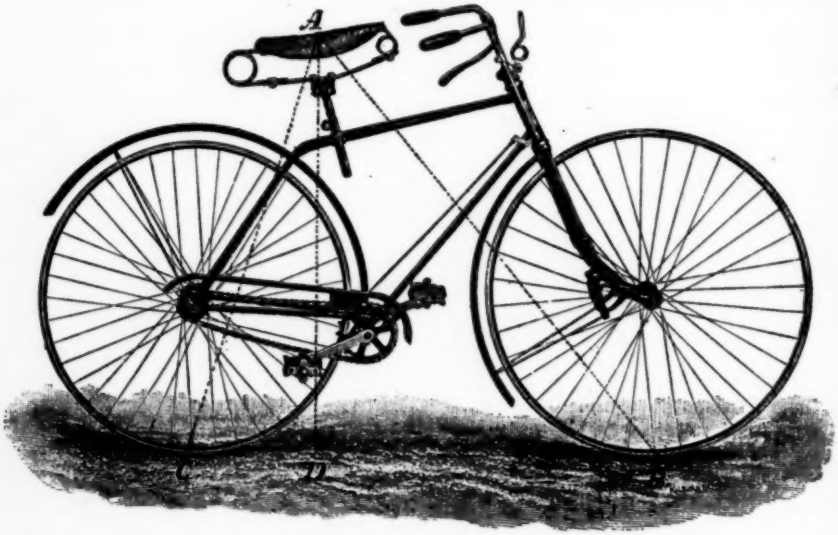


FIG. 7.—A "SAFETY" BICYCLE, WITH LINES OF FORCE.

the lines of force and the weight on the saddle (Fig. 8). It consists, as you see, of two long, slender pieces of pine, and looks like a huge capital A, the cross-piece serving merely to hold the whole more firmly together. At the apex, A, I have placed a few pounds of lead to represent the rider's weight.

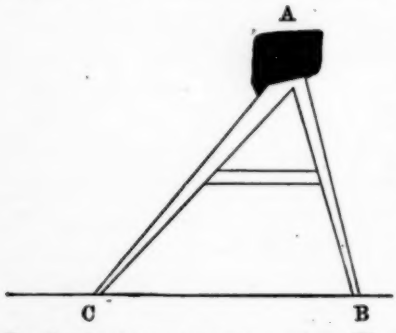


FIG. 8.—APPARATUS ILLUSTRATING THE WAY A BICYCLE IS KEPT UPRIGHT.

In the older form of the bicycle, the wheel in front is very much the larger. The corresponding leg, A B (Fig. 8), is much steeper and shorter than the other. In "safety 'cycles" it is just the reverse, the rear leg being steeper and shorter, while the two wheels are of nearly the same size. As the theory of both machines is the same, I shall, for the present, speak only of the former.

For convenience in handling, and that it may be better seen, I place the foot C, the rear one, on the table, and hold the other, B, in my hand, and at the same height from the floor. Now, notice: the weight at the apex, or saddle, begins to tilt to the

right; I quickly move my hand to the right till it comes under the weight. If the saddle tilts to the left, I move my hand quickly to the left. In every case, by moving my hand more rapidly than the weight tilts, I bring the point of support under it. It is very easy in this way to keep the weight from falling; and that is the way the bicycle is kept upright.

But you will ask, How can the rider move the point of support when it is on the ground, and several feet out of his reach? He does it by turning the wheel to the right or left, as may be necessary—that is, by pulling the cross-bar to the right or left, and thus turning the forked spindle between whose arms the steering-wheel is held and guided.

But, some one will say, How does turning the wheel bring the point of support to the right or left—whichever the machine may happen to be leaning?

Let us suppose a 'cyclist mounted on his wheel and riding, say, toward the north. He finds himself beginning to tilt toward his right. He is now going not only north with the machine, but east also. He turns the wheel eastward. The point of support, B (Fig. 6), must of necessity travel in the plane of the wheel; hence it at once begins to go eastward, and, as it moves much faster than the rider tilts, it quickly gets under him, and the machine is again upright. To one standing at a distance, in front or rear, the bottom of the wheel will be seen to move to the right and left, just as I moved the foot of the skeleton frame a moment ago.

I conclude, then, that the stability of the bicycle is due to turning the wheel to the right or left, whichever way the leaning is, and thus keeping the point of support under the rider, just as a boy keeps upright on his finger a broomstick standing on its smallest end.

It may be questioned whether the bottom point of the wheel really travels faster than the weight at the saddle tilts over, and, if it does not, then the explanation which I have been giving fails.

By an easy calculation, based on the well-known principle that the velocity of a body moving under the influence of gravitation varies as the square root of the height from which it has fallen, irrespective of the character of the path it has described, I find that when the rider's seat is, e. g., sixty inches high, and the machine has inclined, say, six inches out of the perpendicular, it is at that instant, if free to fall, tilting over at the rate of much less than a mile an hour. But six inches is a large amount to lean—a good 'cyclist does not lean that much—we will suppose him out of plumb only three inches; then his lateral movement will be at the rate of only some twenty-two hundred feet in an hour. If the tilt is less, the falling rate will be less. To keep the center of

gravity over the base, the bottom of the wheel needs only to move to the right or left—whichever the machine is leaning—somewhat faster than these slow rates. There is no great difficulty in doing this, for, if the bicycle is going eight miles an hour, it is necessary to change its course only about seven degrees; if four miles, then only about fourteen degrees; if two miles, then about twenty-eight degrees. The greater the speed, the less the angle: at sixteen miles an hour, the wheel would need to be turned less than two degrees. From which follows the fact, well known to 'cyclists, that the slower the machine is traveling the more the handles must be turned, and the more difficult to keep from falling.

From the fact that the bicycle is kept erect by keeping its point of support under it, like a pole standing upright on one's finger, some curious and, to most persons, quite surprising results follow. I have here three rods, respectively one foot, three feet, and seven feet long. I hold the last, as you see, very easily; the second not so easily; and the first only with considerable difficulty. I now put a cap of lead weighing four or five pounds on the top of each, and then again support them as before. In every case it is now easier to keep them from falling. Hence, in a bicycle, the higher and the heavier the load, the less the danger of falling; and, as most of the weight is in the saddle, the center of gravity of the whole is very near it, and it is the height of that, and not the size of the wheel, that affects the lateral stability. A rider with a load on his back, whether a bag of grain or a man sitting on his shoulders, is by all that the more safe from falling either to the right or left, however it may be as to headers.

Experts sometimes ride for a considerable distance with both legs over the cross-bar. But there is nothing strange in this, for placing their legs in that position only raises the center of gravity, and hence really adds to the stability. If in some way they can manage to turn the cross-bar, they can ride without difficulty until the momentum is exhausted.

A much more difficult feat is to ride on one wheel. The small wheel—the rider holding the other in the air—is most easily managed. It is merely a case of supporting on a small base a long, upright body. One keeps moving the point of support so as to bring it under the center of gravity. It needs only a quick eye and a steady hand. It is much more difficult when the 'cyclist uses only the big wheel, the other having been removed, for he is liable to fall forward or backward, as well as to either side. To avoid the first and second, he leans forward a little beyond his base, and would pitch headlong, but that he drives the wheel forward by means of the treadles just fast enough to prevent it. We all do the same thing when we walk. We lean so far forward

that we would fall, did we not keep moving our feet fast enough to prevent it. On the single wheel most of us would fail, because from lack of experience we would make the wheel go too fast, and so would fall backward; or else, not fast enough to keep from falling on our faces. As to falling sidewise, that is prevented exactly as when both wheels are used—the rider turns the cross-bar to the right or left, and propels the machine in that direction. Experience, a level head, and a steady hand tell how far to turn it.

From mere inspection of Fig. 6 we see that safety against headers varies inversely as the height of the saddle, and directly as the distance from the foot of the perpendicular A D to the forward point of support B (Figs. 6 and 7). In other words, the higher the saddle, the greater the danger of headers; and the farther back, the less the danger.

As to the law of lateral safety—i. e., against falling sidewise—it is in one respect the reverse of the other, for the greater the height of the saddle, the easier not to fall to either side, just as it is easier to keep upright on the end of my finger a long stick than a short one.

PROFESSOR HUXLEY ON THE WAR-PATH.

By the DUKE OF ARGYLL.

I.

ON the boundless subject of religion it is not possible for any man, within the limits of a magazine article, to set forth his whole mind. If those who write such papers have cause to feel this, those who read them have not less occasion to remember it. Misconception is a constant danger. Beliefs which seem to be vehemently repudiated may nevertheless retain some hold when differently expressed. Doctrines which seem to be insisted on with passion may yet not be held without important modifications. These reserves may not be expressed only because the occasion for expressing them did not seem to arise. Large portions of the whole subject may be left out of view. Those which are actually dealt with may be treated, from the accidents of controversy, in a narrow and angry spirit.

It is with a sincere desire to remember all these reasons for caution that I now call attention to the article by Prof. Huxley published in this Review for the month of July, 1890.* But, in full remembrance of the caution, we may fairly say that this article is an open and avowed attack upon Christianity. Nobody has any right to complain of this. But everybody has a right to

* Ninteenth Century, July, 1890, The Lights of the Church and the Light of Science.

identify and recognize it as a fact. That article is not a mere attack upon certain narratives and traditions of the Old Testament, on the ground that they have been incautiously admitted as integral parts of Christian belief, while in reality they need not and ought not to occupy any such position. On the contrary, this contention is repudiated expressly, and with scorn. Prof. Huxley patronizes the school which insists on the barest literalism in the interpretation of the Hebrew Scriptures. He refers to Canon Rawlinson's Bampton Lectures (1859) as asserting that "the narratives contained in the canonical Scriptures are free from any admixture of error."* He praises the justice and candor of the lecturer when he asserts as distinctive of Christianity among the religions of the world, that it claims "to be historical."† He represents him as insisting that Christianity is surely founded "upon events which have happened exactly as they are declared to have happened in its sacred books."‡ He further ascribes to the lecturer the argument that the "New Testament presupposes the historical exactness of the Old," and that the demonstration of the "falsity" of the Hebrew records, especially in regard to those narratives which are assumed to be true in the New Testament, would be fatal to "Christian theology."* Having thus nailed the colors of Christianity to the bare poles of the very barest and narrowest literalism, the professor jumps and leaps upon this teaching as giving him an easy fulcrum for tearing those colors down. He is enchanted by the reasoning of the Canon. He adopts it with effusion. "My utmost ingenuity," he says, "does not enable me to discover a flaw in the argument thus briefly summarized."‖ Nor does he conceal the full sweep of the destructive work which he desires it to accomplish. Not only the whole story of Creation, the whole story of the Fall, the whole story of the Flood, the whole story of Abraham and of any special mission to the Hebrew people, but even the glorious idea and hope of a Messiah—the whole Messianic doctrine which binds the Jewish and Christian Churches—all are relegated to the same category as the Greek myths about Theseus or the Latin stories of the regal period of Rome. And, as the writers of the New Testament have believed those stories and dwelt upon them, the authority of those writers is denounced as that of a body of men who "have not only accepted flimsy fictions for solid truths but have built the very foundations of Christian dogma upon legendary quicksands."△

This language—with plenty more of it—is unmistakable. Its tone is that of the whole article. It must be accepted, therefore, as a pronounced attack upon Christianity all along the line.

I do not stop to inquire whether the doctrines of biblical inter-

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* Page 7. † Ibid. ‡ Ibid. * Ibid. ‖ Page 8. △ Ibid.

pretation which he ascribes to two eminent divines of the Church of England are or are not fair and correct summaries of their teaching. Fortunately, on this subject we are not at the mercy of any individual divines whether living or dead. The Christian Church, with its long and varied history of nearly two thousand years, has never been committed to it. The doctrine indeed of verbal inspiration, though never defined and never authoritatively adopted by any Christian Church, has been often widely prevalent. But even this doctrine is exaggerated, distorted, and made ridiculous by its development in the hands of Prof. Huxley. As patronized by him, the law of interpretation applied to some of the most ancient records of our race would exclude all the elements of allegory and of metaphor, of imagery, of parable, and of accommodated presentation. And this, too, when some of these records purport to set before us an idea of the origin of things. The argument is not only illogical but grotesque, that because Christianity claims to be an historical religion, therefore it follows that any accepted narrative attempting to give us some conception of the creative work, must do so in words as literal and prosaic as an account of the execution of Charles I.* Creation, strictly speaking, is inconceivable to us. And yet creation is a fact. The system of visible things in which we live was certainly not the author of itself. If we are capable at all of receiving any mental impression of its beginnings we can only do so through modes of representation which are charged with allegory. In his own special science no man has declared more clearly than Prof. Huxley that the limits of our observation are not the limits of our knowledge. Biology, for example, declares as its verdict, after much evidence has been taken, that, as matters now stand, the living is never generated by the not-living. Every form of organic life comes from some other older form which has already been established. But he points out that this has no adverse bearing upon the deductive conclusion that life must have had its first beginning otherwise. On the contrary, he admits that conclusion to be certain. "If," says he, "the hypothesis of evolution is true, living matter must have arisen from not-living matter."† I venture to add that whether the theory of evolution be true or false, or whether (as is more likely) it be partly true and partly false, the certainty of this conclusion is not affected. But if that beginning is to be rendered conceivable by us, it can not be expressed in the language of experience. We have no experience to go upon. Of necessity, therefore, the very idea of a beginning must be dealt with in the language of metaphor or allegory. Accordingly, even Darwin was compelled to have recourse to the

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* Page 7. † Encyclopædia Britannica, ninth edition, vol. iii, Biology, p. 689.

familiar imagery of the Hebrew Scriptures when he had to express his idea of the origin of life. There were certain germs, he assumes, into which "life was first breathed." What should we think of the rationality of a man who interpreted Darwin to believe that there was some big Being who originated life by emptying his lungs into certain bits of protoplasmic jelly? Yet this is the law of interpretation which Prof. Huxley would impose upon the magnificent symbolism of Genesis. The events described—avowedly transcending the region of experience—must have happened "exactly as they are declared to have happened in the sacred books." When we are told that God said, "Let there be light," we are to interpret this sublime image as an assertion that the Almighty did actually address this sentence in a definite language to the brute elements of chaos. We are to understand that the words thus attributed to the Creator were actual words, like the words spoken by King Charles to Bishop Juxon on the scaffold at Whitehall. If we don't believe this, we are to believe nothing whatever coming from writers so unhistorical. In like manner, when we are told of the Almighty walking in an earthly garden "in the cool of the day," * and when the narrative seems to imply that Adam saw him and hid, we are to understand this baldly and literally as an actual midday scene in a shady wood somewhere in western Asia. Such is the childish argument which is to destroy Christian theology—such is the kind of logic in which Prof. Huxley can not, for the life of him, see any flaw. St. John may perhaps be credited with knowing, at least as well as the professor, what would and what would not be fatal to Christian theology. Yet he does not seem to have been even conscious of the difficulty. Passages even stronger and more definite in the Old Testament, involving hyperbole, metaphor, and imagery, stood nothing in his way. He must have known the famous passage in Exodus † in which Moses is represented as having spoken with God as a man speaketh with his friend. Yet the professor's canon of interpretation is unknown to him. "No man hath seen God at any time" is the grand sentence of the apostle. ‡ But the extension of this argument to destroy all authority as belonging to the writers in the New Testament is perhaps a still more remarkable illustration of the reasoning which the professor considers to be faultless. Men who accepted such narratives as those of Genesis are not to be trusted as themselves historically safe. If St. Paul did really believe in those primeval narratives we can not trust him when he tells us of the light which burst upon him on his way to Damascus, and which changed him from a persecutor of the faith into the great

* Genesis, iii, 8. † Exodus, xxxiii, 11. ‡ John, i, 18.

apostle of the Christian Church. And so of ourselves. If we do not consider ourselves bound to hold that an actual serpent was selected as the most persuasive advocate of evil—if we are disposed to think that there is all the air, and all the most obvious characteristics, of allegory in such words as the "tree of the knowledge of good and evil"—if we do not accept it as a literal fact that the rotation of the earth was suspended to keep the valley of Ajalon above the horizon for a longer time than was due to the season of the year, then we are equally bound to distrust the truth of the migration of Abraham, and of the sojourn in Egypt, and of the conquest of Palestine, and of the Babylonish captivity, and of the stream of prophecy pointing to some great Deliverer not for the Jews only but for all peoples—and of the life and death and teaching of our Lord. The whole argument, I confess, appears to me to be not only illogical, but irrational.

This is a subject, however, of vast extent on which we have no right or reason to expect any special light or guidance from Prof. Huxley. Even if he approached it in the careful and cautious spirit in which he has generally dealt with his own noble science of biology, it would not follow that he could deal with it as well. We know the confession which Darwin has made of the effect upon his own powerful mind of exclusive devotion to one class of ideas and to one purely physical pursuit, in rendering him comparatively insensible to the whole class of conceptions which are the warp and woof of the higher branches of philosophy. Even in this article, Prof. Huxley tells us that when he tries to follow those who walk delicately among "types" he soon "loses his way."* This is a strange confession to make when even in his own special science "type" is one of the most familiar of all words, and when the suggestions connected with it—for example, on the general development of the vertebrate skeleton—are confessedly of the most profound and far-reaching interest. It is still more strange when he himself—walking so delicately as to be most difficult to follow—has tried his hand at the definition of a "type." It is, he says, a "plan of modification of animal form."† He tells us he has "a passion for clearness." Is the above definition perfectly pellucid? All animal form is in itself a "plan." Each modification, we now hear, is another "plan." Is this what he means? And if so, what does he mean by a "plan"? Does he mean what all other men mean by the word—some mental conception with a view to the future? Or does he mean only some accidental pattern such as a drop of water may leave when it splashes on a window-pane? Then, what does he mean by a "modification"? Does he mean some wonderful adaptation to

* Page 20. † Comparative Anatomy, p. 7.

some special use? And if he does, how does he account for that adaptation arising exactly when and where it is needed? Was it purely accidental? Does he worship at the shrine of the great goddess Fortuity? Where is his "passion for clearness" when all these questions are evaded? If he finds such mysteries in a purely physical science, why should he sneer at conceptions also "seen through a glass darkly," in the spiritual regions of belief? He is certainly narrower than the higher aspects even of his own pursuit. But, besides the cramping effect of all specialisms when exclusive, Prof. Huxley has most clearly approached the subject under the strongest animus. "The slings and arrows of outrageous" clerics at church congresses seem to goad him on. His one desire appears to be to trample on them. If he can here and there catch some popular divine committing himself to some argument or idea which may be ridden to the death, he hugs it with effusion. He gives it the requisite dressings of his own verbal evolution. Then turning round he endeavors to tie down the whole of Christian theology to ridiculous conclusions under the choppings of a childish logic.

But there is one thing we had a right to expect from Prof. Huxley, and that is, that when in the course of his argument he comes across questions of purely physical science, he should treat them as candidly and fairly when they are supposed to bear upon "Christian theology" as when he delivers a scientific lecture or writes an article for an encyclopædia. Yet this is just what he has failed to do in the case before us. His canons of biblical interpretation are not more crude and violent than his dealings with the discoveries of geology, and still worse, if possible, his dealings with the things which geology has not yet discovered. I proceed to define and illustrate what I mean.

Prof. Huxley selects the story of the Deluge as his particular battle-horse in the fight. He is quite right, and well within his right, in doing so. That story is special in the fact that it purports to give an account of an event within the limits of human experience, and that in doing so it narrates occurrences which may to some extent be brought within the cognizance of discovery in more than one branch of physical science. Prof. Huxley has a very definite theory as to the origin of the story. He thinks it probably arose out of some terrible inundation of the two great rivers of Mesopotamia.* This is quite an intelligible hypothesis, since we know from the facts of our own day, in the case of the Yellow River in China, what an enormous destruction of human life may be caused by river floods bursting in upon low, flat plains thickly peopled. But this hypothesis fails to give any adequate

* Pages 14, 15.

explanation of the universality—or nearly so—of the tradition of a great flood among all branches of the human race. The late eminent French scholar Lenormant marshaled and collated the evidence on this subject not long ago, and came to the conclusion that a tradition so wide-spread, if not actually universal, must have arisen from the memory of some great catastrophe which did actually take place, and had left an indelible impression on the progenitors of every race. Prof. Huxley takes no notice whatever of this argument, although the fact on which it rests is fairly stated in a careful and temperate article by Dr. A. Geikie, upon the Deluge, to which the professor himself refers.* No hypothesis which does not take notice of this fact can rest on adequate scientific reasoning.

The question then naturally arises whether it is or is not possible that there may have been, since the birth of man, some great catastrophe far more wide-spread than the inundations of any river; and whether the narrative in Genesis of the Flood may not be the account of this catastrophe—told in its religious aspect, just as the previous narrative of Creation is an account of that (to us) inconceivable operation—told in the same connection—that is to say, in its connection with the final causes of the Divine government and action.

Now, in dealing with this question scientifically there are three things which must be done: first, there must be a careful view given of the purely physical phenomena which are really of necessity involved in the form of the narrative in Genesis as it has come down to us; secondly, there must be another view given, as careful and complete, of any conclusions relative to the subject which have been really established by geology or by any other branch of the physical sciences; and, thirdly, there must be a frank and free confession of the ignorances of science—of the problems which it sees but which hitherto it has failed to solve, and of the unexhausted possibilities of physical causation which lie wholly unknown behind them. Prof. Huxley's article does not comply with any one of these conditions. He does not state fairly, but on the contrary most unfairly, what the narrative in Genesis does of necessity involve. He does not set forth fairly what are the related facts which geology may claim to have established; while—above all—with regard to the ignorances of science, he seems wholly unconscious even of that sober estimate of his favorite agnosticism which true science impresses on us all.

He starts with songs of triumph over the very general abandonment of the idea that the Deluge could have been universal, complete, and simultaneous over the whole globe. He might as

* Kitto's Encycl. of Bibl. Lit. Deluge.

well be jubilant over the cognate fact that the six creative days in Genesis are now never thought or spoken of as compelling us to believe that the whole creative work which has been done on our planet since it was in a state of chaos, was a work accomplished within six literal days of twenty-four hours each. Or he might as well shout over the still older movement of thought which divorced the conceptions of the Christian world from the literal language of the geocentric astronomy. It is quite a mercy that Prof. Huxley has not trotted out our old friend Galileo again, and has taken refuge in such later and lesser lights as the late Canon William Harcourt, and the still living Canon Rawlinson. But even on this question of the possible universality of a deluge, Prof. Huxley takes no notice of certain features in the Hebrew narrative which manifest a most curious avoidance of the real scientific objection to a complete and universal deluge, in spite of some language which appears to assert it. It is not true, so far as I know, that any science has proved a universal deluge to be a physical impossibility. In particular, it is not true that there is any deficiency in our existing oceans of a quantity of water adequate—more than adequate—to cover the whole earth. On the contrary, it is a fact that the actual distribution of sea and of dry land on our planet is such that even a comparatively slight elevation of the floor of our oceans, together with some corresponding depression of the land, would spill over upon our continents enough water to submerge them completely, and to submerge them all. My distinguished friend Dr. John Murray (of the Challenger Expedition) has calculated that there is enough water in our existing seas to cover the whole globe with water more than two miles deep. This is the latest calculation of scientific inquiry, and it is curious. The fundamental objection to a complete and simultaneous deluge at so late a period of the earth's history is not physical but biological. It lies in its bearing upon the history and development of organic life. Even this objection applies only to the completeness, and not to the universality, of a deluge. That is to say, biological facts may be perfectly compatible with the partial and contemporaneous submergence of every continent on the globe, but not with any such submergence having ever been total or complete. As regards the lower animals, there must have been, so far as we can reason, other refuges than an ark. There must have been many areas left uncovered. But this necessity is demanded quite as much by the narrative in Genesis as by the scientific evidence of the distribution of life. The repeopling of the deluged earth by ordinary generation requires this absolutely. The universal destruction of all terrestrial life would have necessitated a complete re-creation of all its forms. And yet this is exactly the consequence which the narrative in

Genesis definitely excludes. The writer ascribes the subsequent repeopling of the earth, both as regards the lower animals and men, not to any re-creative work, but to ordinary generation. The divine employment of natural means is the dominant idea of the whole narrative. But seeing that the dimensions of the ark represent a vessel considerably smaller than the Great Eastern, it is clear that without what are called miracles on the most stupendous scale—which the writer does not seem at all to contemplate—the whole creatures of all the continents of the globe could not have been represented in it, even if they could have been brought together and congregated in one spot in western Asia. The writer or writers of the narrative in Genesis, or those still older recipients of tradition in whose hands that narrative grew into its present form and through whom it was transmitted, had presumably no more knowledge of the very existence of the New World, or indeed of the extent of the Old World, and of the quantity of animal life which swarms upon both, than they had of the nature of the sun or of the orbit of the earth. What they conceived or thought upon this subject has no moral or religious significance. Whether the American mastodon and megatherium, and the European mammoth and the woolly rhinoceros, and all the other huge Pleistocene mammalia, were saved at all, even in single couples—whether all the lesser mammalia which have survived could or could not be saved from drowning by the refuge afforded in a single vessel—these are questions which do not seem to have been even thought of. Accordingly, the writer of the Epistle to the Hebrews does not even take the smallest notice of such questions, or, at all events, brushing them aside, fixes on the central conception of the whole narrative, the effect of the Deluge upon man, and the personal relations between one faithful patriarch and the Almighty Disposer of all events. He tells us that this one man "by faith, being warned of God of things not seen as yet, moved with fear, prepared an ark to the saving of his house."* Here we have the whole essence and purport of the narrative in the Old Testament condensed, and reproduced by a Christian disciple who, whatever his name, is certainly, humanly speaking, one of the most powerful among the writers of the New. It matters nothing to this view of it, whether the Deluge was or was not conceived to be literally universal, complete, and simultaneous. It matters nothing what may or may not have happened at the same time to the kangaroos of Australia, to the moas of New Zealand, to the giraffes and countless antelopes of central Africa, or to the llama and tapir world of the South American continent. If there is any

* Hebrews, xi, 7.

good scientific reasoning, as I think there is, which seems to prove that no deluge can have been at once complete, universal, and simultaneous, over the whole globe, then there is no more reason to believe it than there is to believe in the literal interpretation of the passages involving the rotation of the sun round the earth, or the still more striking passages which we have seen so summarily dealt with by St. John.

Leaving, therefore, Prof. Huxley to his jubilations over the general abandonment of a deluge at once complete, universal, and simultaneous, let us see how he proceeds to deal with the alternative of a deluge which may have been enormously wider than the Mesopotamian Valley, and yet may have been partial only—as regards the whole area of the globe.

The device of the professor is to assume that belief in any such deluge must of necessity involve the notion that while the existing levels of the land were fixed or unmoved, the waters were heaped up over some portion of it, without any containing banks or walls to keep or hold them in their new position. Over this ridiculous idea he runs riot and enjoys quite a happy time of it. He shows triumphantly how it contradicts the fundamental laws of hydrostatics, how impossible it is to conceive any agency by which such a heaping up of loose waters could have been effected, and how tremendous must have been the outrush when any (inconceivable) restraints were removed. Now I am not concerned to inquire whether this conception as to the cause of a partial deluge has or has not been ever formulated or distinctly pictured by any human being. Considering the absolute and wide-spread ignorance of all the physical sciences which prevailed in the world for centuries, it is quite possible that something like this may have been one of the popular ideas concerning the Deluge. It is perfectly natural that it should have been so. That in this world of ours the solid earth is the stable, while water is pre-eminently the unstable element, is the universal prepossession of mankind. It is not overcome even in countries where the land is often trembling under earthquakes or subject to the ravages of volcanic action. Over by far the largest part of the habitable globe, where men have not even these suggestive experiences to consider, the preconception is insuperable that the land is comparatively steady and that the sea is the most liable to change. That this preconception should have governed the reasonings of prescientific ages and of ignorant men of the present day is not astonishing; but it is most astonishing indeed to see it patronized by Prof. Huxley. The very first lesson of all geological science is to teach us and to make us familiar with the idea that in all relative changes between the areas of sea and land the element of constancy is in the liquid water and the element of mutability is in

the solid earth. The sea is bound by the most rigorous laws to keep its general level. The dry land is under no similar bondage to keep either its general or its local elevation. On the contrary, the same great force which keeps water with its peculiar properties in a fixed relation to its supports is the very force which ceaselessly tends to make those supports yielding and unsteady. It is true, indeed, that the ocean leans against the land with an attracted bulge. This bulge is not visible to the eye, nor can it, perhaps, be measured by any mechanical instrument; but the mind of man has recognized it as a necessary consequence of the law of gravitation. All land-masses above the water must attract more or less the sea which is beneath them. Independently of this, from ordinary hydrostatic causes, the ocean must always be lipping over along its shores—ever ready, as it were, to take instant advantage of the smallest movement of depression. Deluges, therefore, by submergence are ever on the cards. They are the easiest and most natural operations in the world. Of course, Prof. Huxley knows all this, and, of course, he does not commit himself to any other doctrine; but he does argue against a partial deluge as if it involved of necessity the vulgar error of the sea being raised up and heaped over any area which may have been submerged. This is not ingenuous. What is the value of a scientific argument against any supposed occurrence which rests entirely on a popular delusion as to the physical causes by which that occurrence may have been brought about, while the controversialist knows all the time that the very same occurrence might very easily have been brought about by other causes perfectly natural and perfectly easy to conceive? Yet this is the way in which Prof. Huxley prances on his selected battle-horse of the Deluge. He elaborates picture after picture of the physical consequences involved in a partial deluge effected by a heaping up of unsupported waters over a fixed and steady land, and then he stamps upon the nonsense which he has himself adopted—in so far at least as it is useful to him, and has intensified where it could be made to be so.

This perverse dwelling upon an absurd physical conception, as a means of raising prejudice, is all the more gratuitous and irrelevant since, wherever else it came from, it certainly did not come from any description contained in the Hebrew narrative. On the contrary, one of the most salient and even mysterious characteristics of that narrative is that it is absolutely inconsistent with the idea of sudden, violent, and torrential action. Prof. Huxley himself, in the midst of his strained denunciation of what must have been involved in any partial deluge, stumbles on the fact that the Hebrew narrative assumes a rate of movement so slow and gradual that "if it took place in the sea, would be over-

looked by ordinary people on the shore."* I say he stumbles upon it, because he mentions it only in so far as it comes handy for the purpose of showing the inconsistencies of the popular notions of heaped-up waters upon a steady land. But he does not deal with it or consider it in its true connection—namely, as showing that this popular notion finds no support in the Hebrew narrative. Dr. Geikie's early paper on the Deluge, written not lately but some thirty years ago, stands, as regards this, in creditable contrast with the heedless representations of Prof. Huxley. Dr. Geikie did, indeed, fall apparently into the same strange error of holding that every partial deluge must of necessity have involved a universal one, an argument which rests wholly on the notion that any such deluge must have been caused by a heaping up of water over a stationary land. But Dr. Geikie, with characteristic sagacity, emphasizes and dwells upon the fact that the Hebrew narrative does not suppose any violent or convulsive action, and that in this respect the popular imagination of it has been quite unjustified.† But even Dr. Geikie's paper, fair and candid as it intended to be, does not point out the unquestionable conclusions, that the whole idea of the narrative in Genesis assumes a deluge caused by a slow and gradual subsidence of the land, and not caused by any capture of it by some sudden assault and battery of the sea. This conclusion does not depend on the true meaning of archaic and obscure expression, such as the "breaking up of the fountains of the great deep," which are almost incapable of an exact physical interpretation. It depends on the structure of the whole narrative, and on the incidents which it includes. Its importance does not lie in any question touching the sources of that narrative, or the conceptions entertained by those who have handed it down. Its importance depends on the suggestion which arises out of it, whether intended or not, that the physical impossibility of a partial deluge is an argument founded on the most ignorant of all preconceptions, and is demonstrably the grossest of all delusions. That there can not have been partial subsidences of the crust of the earth—even on an enormous scale—would indeed be an ignorant proposition, contradicted alike by theory and observation.

But here we come to another branch of the subject, on which, if anywhere, we had a right to expect from Prof. Huxley something better than the most loose and yet the most dogmatic declamation. This branch is that which deals with the actual discoveries of modern science, so far as they bear upon the question. Geology is a science which has made such rapid and enormous progress during a period spanned by the extreme measure of a

* Page 15. † Kitto's Encyclopædia of Biblical Literature, Deluge, p. 243.

single human life, that we are all apt to be a little drunk with our own success. And yet that progress has been marked by incidents which should make us sober. The field, though a small one, on which its victories have been achieved, is strewn with the bodies of the slain. Dead theories and abandoned speculations lie thick upon the ground, while some of the most mischievous preconceptions still encumber the progress of inquiry. One of the first great general conceptions which lifted the speculations of mere cosmogony to the dignity of a science, was the Huttonian theory.* One part of it was securely true. Another part of it was profoundly false. It was true as regards the continuity of causes. It was also as regards the uniformity of their effects. It was true that the rocks have been built up by the interaction of the forces of elevation, and the forces of degradation and depression. It was true that the causes which heaved the hills, have been ever met and checked by causes which wore them down again. But it was not true that the operation of higher laws is never indicated, or that all we can ascertain is limited to a perpetual seesaw of monotonous repetition. As usual, there were many minds which valued the Huttonian theory not for its truths, but mainly for its deficiencies and errors. The school of thought that delights to shut out those fountains of power from which all thought has come, were enchanted with a conception which reduced creation to the dull rounds of mechanical necessity. It was enthusiastic over the famous formula that geology saw "no trace of a beginning, no symptom of an end." In this form it may be called the great hurdy-gurdy theory. Then came the discovery of a clew by which an order of succession could be established in time, and, with time, in the perpetual introduction of new forms of life. Of course the mechanists set to work again, and they are at work still. Lyell supplied them with the only philosophical basis on which they can stand at all, and preached the doctrines of uniformity with immense knowledge and with infinite skill. As in the previous case of the theory of Hutton and of Playfair, much of what he taught was true, while the errors and exaggerations of his teachings are now being gradually but surely left behind. "The bit-by-bit theory of our friend Lyell will never account for all our facts," was the observation made to me one day by Lyell's compatriot, friend, and equal, Sir Roderick Murchison. On this subject happily there is no need of controversy with Prof. Huxley. He has himself taken a creditable part in checking extreme opinions and in showing that the doctrine of uniformity, in the only sense in which it can be rationally held, is quite consistent with any amount of catastrophe and convulsion. In fact, the recur-

* Theory of the Earth, by James Hutton, M. D., 1795.

rence of catastrophe and convulsion may be part and parcel of uniformity itself; and so in like manner, when the speculations of Darwin have furnished the mechanists with renewed passion for a new doll, Prof. Huxley has hoisted more than once a caution signal. He has uttered a warning voice against converting a scientific hypothesis into a dogmatic creed.

It was high time. The passionate enthusiasm with which an obscure and confused verbal metaphor has been accepted as solving all the mysteries involved in the origin of new forms of organic life, will one day be seen to have been—what it is—only another great warning example of the impediments which beset the progress of knowledge. That the origin of species may be ascribed to some thing called "Nature" selecting things which did not as yet exist, and could not therefore have been presented for selection, is among those mysteries of nonsense which are not uncommon in the history of the human mind. But even this delusion, prevalent as it has been, is breaking down, and assaults upon it, all too timid though they be, are nevertheless increasing day by day. I have therefore much sympathy with those who on the whole are reasonably proud of geology as regards its past, and are reasonably hopeful of it as regards its future. But its progress, and even our appreciation of its present teaching, is absolutely dependent on two conditions: first, that we bear constantly in mind the wide seas of ignorance which surround the little islands of our knowledge; and, secondly, that we rightly estimate the full sweep and significance of the facts and laws which we can clearly see. It would be difficult to say whether the science has suffered most from forgetfulness of the things that we do not know, or from failure to appreciate or exhaust the consequences flowing from the things we do know. The vision of past worlds which geology presents may be compared to the view of some land seen at a distance upon the ocean, and upon which heavy banks of cloud are resting. Above, mountains and peaks are seen here and there, with outlines cut clear against the sky. Below, capes and headlands and promontories are also seen, cut as clearly against the sea. The middle slopes are only visible at intervals, and some great plains just roughen the verge of the horizon. But all details are lost. We do not even know whether we are looking at one continuous land or at a group of islands. Hills which seem united, or separated only by some narrow valley, may be really far apart, and broad channels of the deepest water may lie between them. So it is with the vast landscapes of the past in the revelations of geology. The general outlines of geological causation are clear enough; and so in broad outline, too, is the general succession of organic life. But both the exact history of the rocks, and the exact history of the creatures which they entomb, are

beset with mystery. We talk glibly of aqueous deposit as the physical origin of stratification; but we know little indeed of the physical conditions under which this agency worked in early times. The scientific naturalists of the Challenger Expedition report as the result of their investigations that nowhere in the existing world of waters have they found going on anywhere such deposits as are necessary to account for the vast massive accumulations of the Palæozoic sandstones.

Before such mountains as those of the Cambrian formation on the northwest coast of Scotland—cut out of the thickness of apparently one continuous deposit—full of the ripple-marks of the sea, and yet destitute of life—the theoretical uniformitarian may well stand abashed. Similar difficulties are crowded into the conditions under which our great storages of carbon were provided for by repeated elevations and depressions of the land, each elevation giving occasion for the growth of a dense and rich vegetation; and each depression potting it up and preserving it for future use. Similar difficulties beset the equally massive limestone formations of the Secondary rocks. But even these difficulties are less serious and less profound than those which beset the progress of organic life. Only, in this case there are some great outlines which are clear and definite. We can see that organic life has advanced from less to more—from low to higher levels—from the generalized to the specialized, and from various functions performed roughly by some one rude and simple mechanism, to the same functions separated, elevated, and committed to the care of selected and adapted organs. We can see how there is some strange but profound analogy between this magnificent line of march and that along which every living creature goes in its individual growth. Just as the science of embryology has in in some measure revealed to us how—that is, in what order—"the bones do grow in the womb of her that is with child," so in the embryology of this planet, as revealed to us in the rocks, we can see the steps of a process which is not only analogous but homologous. That is to say, the two pathways are not only vaguely like each other according to some dim resemblance, but are identical as corresponding parts in one plan, and of one intellectual method. We can see that the past ages were full of prophetic germs. We can see the rise, one after another, of structures which were incipient, useless, or comparatively useless for a time, but destined in the future for some splendid service. Our physiologists, and anatomists, and morphologists are wholly unable to resist this evidence when it is their business to describe the facts. The structure of their own mind compels them to admit it, even when they struggle hard to shut their eyes against it.

Few men have used language more expressive of conceptions

which agnosticism repudiates than Prof. Huxley himself in his purely scientific writings. In his descriptions of the growth of living things, from the ovum to the finished creature, we seem to be listening to a literal reading and exposition of some page out of that book in which all "our members were written when as yet there were none of them." It is surely remarkable that Nature should be so full of the spirit and of the characteristic ideas of Hebrew and of Christian theology. But so it is. In Prof. Huxley's instructive work on the Elements of Comparative Anatomy he is rich in the use of language descriptive of the preparations for that which is to be. Every change that arises in the mysterious egg-substance is explained, as it can only be explained, by its relations with the future. Does a movement begin in the formless mass, establishing a long cleft or groove? It indicates the position "of the future longitudinal axis of the body." Do the lateral boundaries of this groove at one end of it "grow up into plates"? It is that this end is the end which "will become" the interior region of the body, and these plates are the "dorsal laminæ." Do these dorsal laminæ at length unite? It is that they may "inclose the future cerebro-spinal cavity." Does another portion of the mass grow downward instead of up? It is that it may "form the vertical laminæ," with a function in the future not less essential.* One thing can only be understood when it is conceived as "laying the foundations" of another.† A second thing can only be understood as "pre-shadowing" the form and relations‡ of a third, and so on throughout. Nor does Prof. Huxley confine this great principle of interpretation to the development of the individual fœtus. This governing idea of referring all organic growth to the work of preparation and prevision, he extends to the whole history of life since it first began. He quotes with approbation, and adopts, the grand generalization of John Hunter, that organization is not the cause of life, but life is the cause of organization. Immense consequences are involved in this conception. Organisms are the habitations and the homes of life, but life must build them before it can settle in them and take possession. An organ is a structure for the discharge of function, but it must be shaped and made before the function can be discharged. This luminous idea sends its searching light through and through the stupidities which confound between things made for use and things that are said to be made by use. Use as an intellectual aim must precede use as a physical cause. And so the prophetic interpretation of fœtal development becomes the only possible interpretation of all organic growth so far as it is known to us. Accordingly, Prof. Huxley interprets the whole his-

* Pages 65, 66. † Page 137. ‡ Page 142.

tory of the vertebrate skeleton, and especially of the vertebrate skull, as the development of a "plan." This is the word he has selected, and which he uses over and over again. A plan—we must repeat—is not a mere pattern, which may arise by accident; it is a construction of which all the leading component elements are parts of one general conception having reference to a future. Such a plan, he tells us, can be traced and identified in all skulls, from the skull of a pike to the cranium of a man. The immense differences which mask this unity of plan are due to successive adaptive modifications, with which, in all their wide extent, the original plan was destined from the very first to work in harmony.

These are grand conceptions. They are scientific conceptions in the highest sense of that word, because they bring phenomena into harmonious relations with the highest faculties of the human mind. They are the conceptions which confer all its dignity and interest on geology, and on the affiliated sciences of paleontology and comparative anatomy. Although in one sense highly ideal, and in the best sense metaphysical, they are yet strictly literal, and absolutely true to fact. Hence Prof. Huxley most truly asserts that the doctrine of "all bony skulls being organized upon a common plan" is a simple generalization of the observed facts of cranial structure.* It is curious that many of those who use these conceptions for the purposes of description immediately turn round and repudiate them for the purposes of philosophy. But the language which embodies them can only be useful for the purposes of explanation by reason of the similitudes which they involve between our own mental operations and those which are obvious in nature. Yet these very similitudes and intellectual homologies are most distasteful to the agnostic school; and very often, even in the mere work of description, every device is resorted to to keep them out of sight. Thus some movements of the nervous and muscular apparatus in animals which involve the most complicated adjustments are constantly spoken of as mere "reflex action"—as if they could be compared with the mere reflection—or bending back—of light from water, or of sound from a wall. So again "differentiation" is perpetually used to describe the processes of preparation by which the building up of special organs is accomplished—just as if these wonderful processes could be described by a word which is equally applicable to the processes of corruption and decay. There is no disloyalty to truth so insidious as that which leads us to sin in this way against our own intellectual integrity. What our mind sees, we must confess to—at our peril. It may have been a brave thing in

* Comparative Anatomy, p. 278.

Nelson to turn his blind eye to the recalling signal of his admiral. But it is not a brave thing—quite the contrary—in any man to turn a blind eye to the instinctive perceptions of his own intelligence.

Nevertheless, it is possible to be true and faithful to the automatic workings of mind within us when it recognizes and identifies the methods of its own vaster image in the external world, and yet to be not less true and faithful to our consciousness of ignorance. The great thing to do is to put our agnosticism not in the wrong but in the right place. We may well rejoice in the clear and grand vision we have obtained through science of organic life having been developed through unnumbered ages on lines which do in themselves constitute a "plan." We may rejoice with the truest intellectual delight in our perception of the relation which this plan bore from the beginning to the future in creation. We may admire without ceasing the combination in this plan between an obvious fundamental unity and a not less obvious fundamental subordination to endless change—wherever new needs had to be met and new functions had to be discharged. All this is science and science of the highest quality; but the sense of it is compatible with a constant remembrance of the enormous gaps in our knowledge which remain unfilled. That which always we are most curious to know remains always also unexplained. Geology has told us of a succession in the forms of life; but it has as yet told us nothing as to the methods by which this succession was brought about. There are, indeed, so-called "links"; but the links are never within each other's touch. The "imperfection of the record" is blamed for this; but there are portions of the record which seem continuous and complete—portions of time which were long enough to see the introduction of new species—and yet the mystery remains unsolved. In the Lias, for example, and in some other formations, we have beds of great thickness following each other in orderly and undisturbed succession. New shells appear in turn, and yet we never see how or whence they came. My friend Mr. Robert Etheridge, F. R. S., F. G. S.,* informs me that there is one bed no thicker than an ordinary mantel-piece in which a peculiar ammonite appears and never appears again. So it is throughout the record wherever it is accessible to us. New forms come like apparitions, and like apparitions they also go. We do not know where such new forms have arisen nor how. We do know that the whole series must have begun somewhere and at some time, in some initial operation which was not that of ordinary generation. We do not know that this initial operation has never been repeated, or,

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if it has been repeated, how often or under what special conditions.

The abstract dicta—the vague verbal propositions—on the strength of which the possibility of this repetition has been denied, are splendid specimens of those cobwebs of the brain which used to entangle thought in the meshes of the scholastic philosophy. The "law of parsimony" is the ambitious phrase under which theorists have hid the stupid notion that what Nature does once she never repeats again, or that results which she has obtained by one method at some one time must never be compassed by the same method again. Hear how magniloquently the great agnostic professor sets forth this marvelous dogma: "If all living beings have been evolved from pre-existing forms of life, it is enough that a single particle of living protoplasm should have once appeared upon the globe as the result of no matter what agency. In the eyes of a consistent evolutionist any further independent formation of protoplasm would be sheer waste." * This is very grand. The limitation of the possibilities of creation by the vision of a "consistent evolutionist" is delicious. It reminds one of the American joke that the planets revolve round the sun, "always subject to the Constitootion of the United States." But, unfortunately for the dogma, it renounces the testimony of facts, while sounder reasonings upon them are dead against it. Nature is economical, but she is not miserly. The prodigality of Nature is more conspicuous than her parsimony. The habitual expenditure and repetition of all her processes is at least more clear to us than her refusals to repeat them. Her fondness for identity of principle in all her various operations is more pervading than her casting aside of any method merely because it has been used already. That bits of living protoplasm, with inconceivably complex potentialities within them, should have been called into being once, and that nothing similar should ever have been done again, may possibly be true; but it is not according to analogy and we can not accept it on the authority of Prof. Huxley. Still less can so weighty a conclusion be hung securely on a gossamer structure of abstract and empty words.—*Nineteenth Century.*

PHOTOGRAPHS of the annular nebula in Lyra, taken at Algiers, and magnified sixty-four times, give the largest images that have ever been obtained of that object, and make it possible to study the distribution of its light with a precision that has not been heretofore approached. Two very clear maxima of light are observable on opposite sides of the ring of unequal brilliancy. The space within the ring, which is dark to ordinary vision, is found not to be wholly destitute of photographic power. Chemical emanations radiate from it, the existence of which was not suspected before.

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* Encyclopædia Britannica, ninth edition, Biology, p. 689.

SOCIAL CHANGES IN CALIFORNIA.

By CHARLES HOWARD SHINN.

WHEN the Central Pacific Railroad crossed the high Sierras, and the Crockers, Stanfords, and Huntingtons, till then obscure Sacramento merchants, gained the first of their long series of industrial and political victories, a country blacksmith, the late Henry Vrooman, afterward State Senator and one of the greatest party leaders ever known on the Pacific coast, said to me: "That railroad changes forever all the conditions of human existence in California. It will never again be as easy to live here."

A thousand times since, events have shown that the gold-miners' El Dorado of 1849, which had become as different from the rest of the United States as South Carolina is from Massachusetts, was readjusting itself to new conditions imposed by the iron links that bound it to the Atlantic slope and the valley of the Mississippi. At first the change was slow and almost unnoticed. Until the close of the war, prices, rates of wages, and the general conditions of life in California, Oregon, Washington, and Nevada remained practically the same as before. Arizona was then but a frontier outpost, and men like Mowry were holding mines with rifle and revolver against the unconquered Apaches. The whole Pacific coast, from the borders of Mexico to Puget Sound, was still forming its own social customs and creating, as did the South, its own literature. The decade of railroad-building was also the decade of the foundation of State universities, magazines, art-schools, and libraries, and, to a remarkable degree, the decade of the beginnings of many private fortunes in mines, commerce, and real estate.

Early conditions of life in California were unusual in the wide range of opportunities offered to men of strong tenacity of purpose. Nearly every one could make money, and a great deal of it, in the decade between 1849 and 1859, but the temptations to spend were enormous. Illustrations of this are usually drawn from the mines, but some of the most characteristic stories come from other sources. In 1853 there were half a dozen men who shot wild fowl and other game in Contra Costa for the San Francisco markets. They could earn fifteen or twenty dollars apiece every day for nine months of the year. One of them saved his money and bought land for a dollar and a quarter an acre that is now covered with buildings; but the rest are forgotten characters, except for a few sentences in the local chronicles respecting their notable bags of game.

Numberless were the contrasts between California life at that period and life anywhere else in the country. Ordinary economic conditions were for a time suspended. Gold was the chief crop of the State, and gold was gold everywhere. The merchants who wanted to make a "corner" in any product need only "corral" all there was of that commodity in California to be safe for days or weeks. Steamers went twice a month to Panama, and the pony express crossed the continent; but we had no telegraph and no railroad, and immigration, after the close of the great gold-rush, was comparatively small and steady. In the midst of this isolation a community developed in which every man of any strength or purpose soon knew and was known to every other man of ability. Thus, in the old mining towns, like Placerville, Grass Valley, Oroville, Shasta, and early valley towns such as Stockton, Marysville, and Sacramento, and coast cities such as San Diego, Los Angeles, San Francisco, and Eureka, and in the hundreds of country neighborhoods, where ex-miners became owners of herds and growers of wheat, isolation produced strong individualism.

The Californian not only gave up his Eastern newspapers, but his Eastern weeklies and monthlies. Cities of the same population as the San Francisco of 1850–'60 seldom have half so long a list of publications. Many of these were illustrated by the drawings of artists like Keith and Nahl. Men drew and painted, etched and engraved, wrote and spoke, for the busy, energetic people of the lands west of the Sierra Nevada. No other audience was possible; no broader field was desired. As the Virginians and the North Carolinians, climbing the Blue Ridge and settling on the lands that slope to the Mississippi and the Ohio, became Kentuckians and Tennesseans in a single generation, so the pioneer men and women from every State of the Union that settled on the Pacific coast became Oregonians and Californians, and founded two as distinct commonwealths as there are in America.

The literary field to which I have alluded is fruitful in illustration. California, before the walls were fairly broken down, had half a dozen weeklies, none of which now remain. They were circulated in every mining camp, some printing ten or twelve thousand copies, and among their writers were Bret Harte, Mark Twain, Noah Brooks, George Frederic Parsons, Ina D. Coolbrith, and such a group of literary men and women as no American city outside of Boston and New York could gather together at that period. A monthly magazine was established, which in a few years gained a circulation of eight thousand copies, and made the reputations of a host of writers. As the sharp pressure of outside competition began to be felt, all or nearly all the literary

journals of California rapidly deteriorated in quality, as they lost home support, and they either suspended or became mere advertising publications. Conditions of literary life in California changed during the decade that witnessed the driving of the last spike of the first railroad across the continent. Most of the writers who had earned reputations went elsewhere, and those who stayed became more and more conscious of the fact that they also should have gone. It is not too much to say that along in the early seventies, Californians, always a reading people, became thoroughly aware of the existence of the publications of the rest of the United States. After the crash that followed, when every local journal felt for the first time the competition that a daily mail implies, a few single-hearted men and women revived the magazine, and an entirely different line of weekly publications was established. The old journals had no models, and practically recognized nothing ouside of "the coast"; the new journals, far less original, and developing as yet no writers of national reputation, have become better established financially, and depend considerably upon a circulation in other parts of the country. The chief characteristic of most of them, however, is an exaggerated dread of being considered "provincial," and one can not gratify them more than by praising the "Parisian style" of their local epigrams and illustrations.

The first literature of California was purely American in its best features, and accurately reflected the frank egotism and splendid energy of the young commonwealth, that had as yet felt little or none of the life-struggle in which the rest of the world was engaged. But when the stress came, and the land of ease and plenty, high wages, large profits, and abundant comfort knew hard times, the only book of the era was Progress and Poverty. Luck of Roaring Camps, Big Jack Smalls, and similarly picturesque studies born of the mingling of Russian, Spanish, and American currents, could no more be written in California. The "Great Bonanza" period came and went; the new Constitution agitation, Kearney's sand-lotters, McGlashan's anti-Chinese boycotters, were chapters in the State's history, but no representative book, except George's Progress and Poverty, came to the surface, though the raw materials of half a dozen novels were contained in this transition era. Instead of crystallizing into permanent literary form, the agitation caused by new economic conditions became chiefly political.

During the period of revolt and uncertainty, business suffered, speculation increased, and many men withdrew capital from California. The railroad-builders had brought the State into the general order of things, and life on the old scheme had become impossible, though the war, the clinging of Californians to gold

values, and the development of the Comstock, long prevented the popular recognition of the gravity of the problem. When knowledge came, it came swiftly and bitterly. Workingmen who had been earning five or six dollars a day, found, in three or four years, that their wages were forty per cent lower. They felt Chinese competition far more, and other laborers were coming in. The farmers found the price of wheat falling, and ships leaving the coast because of railroad competition, so that freights rose. The merchants found the area of tributary country diminished by the creation of other commercial centers. California suffered more in the necessary readjustment than did any other part of the Pacific coast, because its growth had been much more rapid, its resources had been larger, and it had had, in the historic sense, a far more educating environment. The commonwealth of California was not merely the colony of gold-seekers of '49; it was, in the broader view, the result of American energy working upon the old foundations laid by Spanish pioneers of the eighteenth century; it had its missions and its olive groves before the American Declaration of Independence, when all the rest of the Pacific coast was an unknown wilderness. It could not be otherwise than that the change in economic conditions struck to the heart of Californian life, and seemed for a few years to have produced the disaster of a permanent descent to lower ideals.

"Californians," said a brilliant newspaper man to me during that period, "were once the most magnificently liberal race of men on earth; now they have determined to become the most miserly. Once they talked of endowing a university with twenty million dollars; now they have let President Gilman leave them and go to Baltimore. Once they were proud of everything Californian; now they want a foreign trade-mark on everything."

During the period that I have called the transition era, extending over eight or ten years after 1870, political standards in California were lowered to an extent, in both kind and degree, which is difficult to explain, and which has hardly changed since, except for the worse. All the links and fetters of party allegiance were more tightly drawn. The rule of the purse was more and more pre-eminent in every campaign, and no party or faction long resisted temptation. An almost unbroken line of demagogues, numbered and branded by political bosses, and divided with amusing evenness between the Democrats and the Republicans, misruled the State and increased the expenses of government. The lowering of the remarkably advantageous economic conditions of a quarter of a century ago appears to have thrown many unthinking voters into closer relations with "the bosses," and so has made honest politics a more difficult business. It is the most deplorable result of that sudden outbreak of discontent called Kearney-

ism, that a lower, more mercenary political order still prevails. Reform rests with the young men, who are organizing, regardless of party, to work for the purification of politics, and with a new conservative class—the horticulturists.

Stanford's railroad-builders, breaking down the mountain walls, so that the world-spirit surged in, opened the way for new industries, and the same chain of circumstances that delayed the Californian's realization of the end of his Utopia allowed the firm establishment of a vast group of occupations before impossible. Foremost of these was that varied and profitable industry which some have called "intensive horticulture"—the industry that makes an acre produce more food value than a hundred acres of wheat or corn. California made a new start, and escaped industrial ruin, chiefly by reason of vineyards, gardens, orchards, seed-farms, hop-yards, and the whole group of allied pursuits. These industries educated a great number of cattle-raisers and wheat farmers, supplemented by clerks and mechanics with their small savings, into horticulturists. Thus California obtained a new and very valuable class of conservative citizens, well out of debt, and more intelligent than the ordinary farmer. The movement toward horticulture, as a business, began when the Central Pacific was completed, and went on steadily through all the years of ferment. It was the most hopeful movement of the time, for it built up the interior of the State, it broke up the great stock-ranges and wheat ranches, and it promised to restore to California far more than had been lost. As soon as horticulture became established as the great future industry of the State, an era of immigration began, first in southern California, then over the whole region. The inevitable readjustment of forces and shifting of industrial centers followed, and is still in progress.

For fifty years to come horticultural interests will probably increase, and among horticulturists the skilled fruit-grower, owning from ten to fifty acres of land, will best represent his class. Such a person is likely to be more of a business man than the average farmer, and is in closer relations to town and city life. He is compelled to travel more, watches the markets and the fields of invention closer, and represents, all in all, a finer type. A California fruit-grower is in some respects akin to the middle class of suburban dwellers near Boston and New York, with this very important difference, that he actually and constantly makes his living from the soil he owns. The one tendency of his life is toward what may be termed "extreme Californianism," for he is growing almonds or oranges or something or other that can not be produced at a profit in many other places on the continent, and the "glorious climate" is his best friend. But, on the other hand, he is in a skilled business, full of technical details, requiring

plenty of brain-work, and he is selling in the world's markets. Many a California grower of raisins, oranges, walnuts, olives, prunes, or other horticultural products goes to Chicago and New York every autumn, "to keep the run of the field." The drift of Pacific coast life is toward a rapid increase of the number of orchardists. They are organized, too, in a manner unknown among the farmers, and have several times shown unsuspected courage in independent politics. Some of these days professional politicians will have to deal with a new factor—the horticulturist, a distinct evolution from the conservative American farmer type, quicker of brain, less wedded to party bonds, and more capable of understanding the interests of the commonwealth.

This rapid review of some important economic changes of the past fifty years leads naturally to the consideration of the present conditions of life in California. Wages are still high, and all classes of workers should be prosperous. The resources of the State are being developed at a marvelous rate. In 1880 the population of California was 864,000, and the assessed value of all the property in the State was $564,578,036. "Assessed value," in California, means "that amount which the property would bring at a forced sale." In January, 1890, the estimated population was 1,465,000, and the assessed value of property was $1,112,000,000. The deposits in the savings-banks averaged over $87,000,000, and were widely distributed. The assessors' returns for the counties show that lands in city and country, and their improvements, are well divided up among the people, and California is becoming a State of moderate-sized farms and fair but not large incomes.

The wages of ordinary farm hands in California range from twenty-five to thirty-five dollars a month, usually with board. Portuguese, who are already the peasantry of the rich valleys near the bay of San Francisco, expect from twenty-six to thirty dollars, and board themselves. They own small tracts of a few acres, "work out" most of the time, and are a fairly capable though slow class of laborers. Chinese, who are expert in garden and orchard work, are paid the same as the Portuguese. Italians in the vineyards rate at about thirty-five dollars, and board themselves. Skilled labor in some departments of farm and orchard work commands forty or forty-five dollars a month. Pruners, grafters, fruit-packers, teamsters, obtain such wages, and in the lumber districts Americans often get fifty dollars. Commissioner Tobin's report for 1887–'88 gives the statistics of wages paid in California and other places, and a few comparisons with New York wages will serve to illustrate the subject. California bricklayers rate at thirty dollars a week as against twenty dollars in New York; carpenters, twenty-one dollars as against fourteen; masons, thirty dollars as against eighteen; blacksmiths, twenty-one

dollars as against thirteen; draymen, fifteen dollars as against ten; gardeners, eighteen dollars as against nine.

The cost of clothing in California is about ten per cent higher than in the Atlantic States, but the California workman is apt to wear better clothes. The average cost of food is estimated to be higher in California, but the California workman lives better. The cheap restaurants of San Francisco are superior to any in Eastern cities, and one can live there at less expense, or get more for his money, whichever he chooses. Owing to the climate, incidental expenses can be made less in California, and no time need be lost from one year's end to another. Lots are still cheap, and wood, the great building material, is about one third lower than in New York city.

Favorable as are the conditions outlined, the chief advantages are obtained by men. The wages paid to women for manual labor do not compare favorably with Eastern rates. The seamstress is no better off in California than in New York. Men proof-readers receive eighteen dollars a week, while women get nine dollars; men glove-makers are paid twenty or twenty-five dollars, while women have from five to ten dollars; salesmen in stores receive from fifty to a hundred dollars a month, while saleswomen are rated at from twenty to forty dollars. This difference comes partly from the fact that Chinese competition has been especially strong in domestic occupations. As regards teachers, the school law of California says, "Females employed as teachers in the public schools shall in all cases receive the same compensation as is allowed male teachers for like services, when holding the same certificates." In San Francisco the average salary paid to women teachers is $75.16 per month for twelve months. The statistics of the Labor Bureau bring out many encouraging facts about the life of the laboring women of San Francisco. These women number about twenty thousand, engaged in some three hundred occupations. The general condition of the establishments where they are employed is better than in some classes of establishments in the Eastern States, and the hours are shorter. Several "sweaters' shops" have been investigated, and public feeling aroused. In some of the cigar-factories and canneries Chinamen and American girls were found working together, and a law will probably be passed to prevent this. A "workshop and factory inspector," to operate under some general laws such as those of Massachusetts, is needed. The most satisfactory point about the condition of California working girls is the extent to which they "live at home." The tenement-house system has not yet reached San Francisco. With few exceptions the homes of the working women are neat and comfortable. In the interior towns workgirls are paid better, as a rule, than in San Francisco. The

growth of horticultural industries has made so many demands for work-girls in the country that the factory system can not be established in California for years to come.

Many California women are making horticultural ventures. Teachers, clerks, type-writers, and saleswomen seem particularly apt to buy land and plant vines or trees. An association of about a hundred women are becoming florists. Another group is interested in *buhach*, the Persian insect-powder plant. Within a hundred miles of San Francisco the conditions necessary to the successful culture of leading fruits can be obtained. The extent to which women are turning their attention to this field is noteworthy, and must prove one of the important elements in the organization of the "coming California." One finds women directing outdoor operations in every part of the State, and several of the largest orchards are owned and superintended by women.

Labor organizations are strong in California, containing about thirty thousand wage-earners, and collecting over $100,000 a year in dues in San Francisco alone. The trades-unions of San Francisco and vicinity have twenty thousand members. Hours of labor among unorganized classes of workmen range from twelve to sixteen, among the organized classes from eight to ten. In the matter of strikes the trades-unions have sometimes been difficult to control, reckless and dangerous, especially during the "period of transition." Between 1880 and 1886 there were one hundred and seven strikes in California, affecting 6,763 men and women, and losing 1,508 working days, at a cost of $324,639 to the strikers and $311,093 to the employers. Seventy-seven of them succeeded. There were nine lock-outs, all but one among the cigar-manufacturers. Since 1886 the number of strikes and lock-outs has diminished by one half. The largest ones have been in the foundries and iron-works, those industries being in a state of depression. Public sympathy has been with the employers in most of the recent strikes, as the favorable conditions of workingmen in California are well understood.

The Chinese problem, so called, has but little vitality, although it is still a fruitful subject for newspaper editorials and sensational space-writing. The masses of Californians appear to think that the present laws are reasonably well enforced. Orchard and vineyard extensions may cause such a demand for "cheap labor" that the farmers and orchardists, who have hitherto depended a great deal upon Chinese, will form a pro-Chinese party. It was the fruit-growers as a class that broke up and defeated the Chinese boycott in California a few years ago. The ground they take is that they prefer white labor, but they will not see their crops lost when Chinese can be had, and they will not allow any dictation from trades-unions or boycotters. The Chinese now in Cali-

fornia have been greatly benefited by the Exclusion Act. They receive better wages than before, and in many cases better treatment. The more enterprising among them show a tendency to become land-renters, and in a few instances land-owners. A Chinaman's point of view is about this: that the soil, climate, and opportunities of California suit him, and a "dollar and a quarter a day" is as much of a bonanza to him as the "sixteen-dollar-a-day diggings" were to the American Argonauts of 1849. He will stay as long as he can get his wages, and, if the Exclusion Act is strictly enforced, the chances are that his earnings will continue to increase. He has trades-unions of his own, and whenever it appears judicious, he strikes for higher wages and usually gets them. The laws that protect him against the competition of other workers of his own race are exactly to his mind.

Speculation in California has taken a turn of late years. Few persons invest in mining stocks any more, and there are not many other speculative securities. The glories of Pine Street and Pauper Alley have departed. Wealthy men who used to gamble in "stocks" now buy mines instead. Twenty or thirty California operators, who have left the street, have agents and experts visiting every camp from Sonora to Alaska, and the actual mine-workers have gradually secured nearly all the valuable properties of the coast. Speculation in real estate has become the form of investment among the poorer and middle classes. Town lots in new towns have had their day, and acreage now "takes the call." Over whole counties the farmers and fruit-growers are mortgaging lands to buy more lands, believing that they never will be so cheap again. The rule of the wheat-grower is that thirty dollars an acre is as much as he can afford to pay, and ten or twelve dollars is nearer the average cost of the grazing lands now changing to wheat. The rule of the fruit-grower is that he must have only the land that is exactly suited to the business, and he can pay from fifty to two hundred dollars an acre for such land, provided he has capital to plant it at once.

Books of California travel, with hardly an exception, lay stress on the restlessness of life here. "The whole State is for sale" is a commonplace of the tourist. But the average Californian farmer, instead of being a speculator, is as tenacious a land-holder as a Pennsylvania Dutchman. During the whole land speculation period in southern California, hundreds of Los Angeles County ranchers went on raising corn and potatoes as calmly as if the excitement had been a thousand miles away. There are large and fertile counties where nearly every farm for miles along the highways is owned by the man who "took it up in the fifties," or is divided among his children. There are rich valley townships where hardly three land transfers take

place in a year. The old Missourian settlers are slow to sell or change, but equally slow to improve. New England settlers never sell, but extend their acres if a chance offers. The Western "hustlers," and men from the cities, are the ones that lay out new towns and colonies where immigrants can buy ten or twenty acre tracts. Instead of California being a land of rapid changes in land-ownership, it is, on the whole, very conservative in this respect. The large ranches are for sale, but the homesteads are not.

The middle classes of California will always draw their living from the soil. Mining and lumbering require more capital, and manufacturing will not develop to any great extent for many years to come. The products of which the State appears to have a natural monopoly promise to support a dense population, spread over the country in colonies, on small farms, and in loosely built towns. No other part of the United States is developing under similar conditions, and hence the economic history of California has the importance of a new experiment. Wages still high, a generous scale of living, few manufactures, industries largely horticultural, tendencies which rapidly change the better classes of workmen into small land-owners—such are the conditions. What sort of a community will the California of the twentieth century be?

Dr. HENRY T. SCHLIEMANN.

DR. HEINRICH T. SCHLIEMANN, the enthusiastic excavator of the most ancient Grecian cities, died in Naples, Italy, December 26, 1890. He was born January 6, 1822, at Neu Buckow, Mecklenburg-Schwerin, where his father was a Protestant clergyman, poor, but interested in ancient history, and particularly in the excavations at Herculaneum and Pompeii, which were then fresh. Acquiring some taste in these matters and a little knowledge of Latin from his father, young Schliemann's interest in Troy was aroused when he was seven years old by the sight of a sensational picture. in Dr. Georg Ludwig Jerrer's Universal History, of the burning of that city. The book, according to Dr. Irving J. Manatt, in the Independent, is still treasured in Schliemann's library at Athens, and in it, the writer adds, "he has pointed out to me the rude picture of Troy in flames, the sight of which first lodged the seed-thought in his soul." He decided at once that the foundations of such a city must still exist, "covered up by the dust of ages," and determined to make their discovery the purpose of his life. To this determination he adhered through all the vicissitudes of a precarious career. After some four years at the Gymnasium and the Realschule, he was apprenticed in 1836

to a grocer in Fürstenberg, where he worked for five years from five o'clock in the morning till eleven at night on a maximum yearly salary of thirty dollars. He was able to gratify his archæological tastes in this situation by hiring a drunken but learned miller's clerk to recite to him lines from Homer. One day he broke a blood-vessel while trying to lift a barrel, and was discharged as no longer of value to his employer. Utterly destitute, he took passage in a vessel for South America, was shipwrecked, found his way to Amsterdam, and obtained a light employment, in connection with which he was able to read a little every day. He thus gradually acquired a good knowledge of English, Dutch, Spanish, Italian, and Portuguese. In 1844 he entered the office of Messrs. Schröder & Co. on a comfortable salary and began to learn Russian, preparatory to taking an agency for the house in St. Petersburg. He soon started in business in that place on his own account. In 1850 he came to California, where he became an American citizen and the possessor of $400,000. He returned to Russia, continued his business, and learned Swedish and Polish. After the Crimean War he learned Greek and then devoted two years to the study of Greek literature. In 1858 he traveled through northern Europe, Italy, Egypt, and the lands of ancient Greece. Being compelled by a lawsuit to return to Russia and stay there three years, he went into business again and made more money. Before beginning his life-work, for which the opportunity at last offered, he made a voyage around the world and published his first book, La Chine et le Japon, in 1866. Having dug experimentally, without important results, at Ithaca, he began in 1870 his excavations in the Troad to verify the accuracy of Homer's account of the lost Troy, in the literal reality of every part of which he fully believed. He began first at the place called Bounarbashi, which the learned world had agreed was the site of the ancient city. Having dug and examined the topography long enough to satisfy himself that nothing was to be found there, he tried the mound of Hissarlik. Here he unearthed six cities which had succeeded each other on the same site, four of them at least prehistoric, and one of which, bearing the marks of a great conflagration and being rich in relics, he was satisfied was Homer's Troy. For security in performing this work, Dr. Manatt tells us: "As an American citizen he took out our passports for himself, his family, and his servants; and it may as well be remembered that Troy was uncovered under the protection of our flag." The results of these explorations were described in the books Troy and its Remains, and Ilios, the appearance of which was the signal for an active discussion of the merits of his discoveries. While many doubted the accuracy of his identification of one of the cities with the real Troy, it was generally agreed that he had

found something remarkably interesting and important, as well as very ancient, and that possibly the real Troy was somewhere in the heap. Convincing testimony to the value of the investigation was given by Dr. Virchow, who visited the place and examined it, and by a commission of archæologists, who made a special report upon the subject. Dr. Schliemann next turned his attention to Mycenæ, the capital of Agamemnon and the kings of the house of Atreus. Following the directions of Pausanias, he selected a spot, dug, and found, if not the tombs and the treasury of the Atridæ, five tombs of royal rank, with sarcophagi and death-masks, and a treasure-chamber, which he decided to be of equal age. Dr. Manatt says that when the first skeleton came to light in these royal tombs, "he fell upon his knees before it, exclaiming, 'Thus have I imagined my hero!'" The results of this work were described and published in another splendid book on Mycenæ and Tiryns. He next excavated Tiryns, which he had already partly explored and described in connection with his work at Mycenæ, and laid bare the walls and a prehistoric palace and citadel, with the gates, court-yard, hall, chambers, and bath-room. Another volume, corresponding in style with the previous ones, was devoted to the discoveries made here. Dr. Schliemann subsequently made excavations at Orchomenos, the mound of Marathon, and other important ancient sites, and was contemplating further work of a similar character. The value and accuracy of his discoveries have been subjected to unfriendly criticism and much active discussion; but, while he could not prove that the second prehistoric city at Hissarlik was identical with Troy itself, or that the tombs and treasures at Mycenæ actually belonged to the Agamemnon who was murdered by Ægisthus, he was able to repel all efforts to discredit the results he got, and to convince the most accomplished antiquaries and archæologists that, if not these, he had found something very like and very near in time to them. Every kind of hypothesis was tried, as the Saturday Review says, by those who doubted the genuineness of the discovery of Mycenæ, "but only Dr. Schliemann's fitted the case. The bronze blades of the poniards, when the patina was removed, were found to be beautifully chased in various-colored gold, such as Homer describes, with scenes of war and the chase. The art was clearly inspired by Egyptian reminiscences: here were men hunting wild ducks, for example, in a papyrus marsh; here were pictures of such huge shields as Homer attributes to his heroes. The figures, on the other hand, were far more free in execution than those of the earliest known Greek art. In brief, new materials and a new problem were offered to archæology, and the evidence of tradition was once more proved to be more trustworthy than any one had expected." The grandeur of this dis-

covery, indeed, furnished the chief doubt of the validity of the identification of Troy, for "if Mycenæ were so great and strong, why did it need all the power of Achaia to overthrow the little village of Ilios?" His wife, a well-educated Grecian lady who shared his Homeric enthusiasm, assisted him with her sympathy and co-operation in a large part of his researches. Dr. Schliemann's death followed a cold contracted after undergoing a successful surgical operation for deafness at Halle. He tarried for business on his way home, and, failing to take the care of himself

HENRY T. SCHLIEMANN.

which he needed and which prudence should have demanded, caught a severe cold, and had stopped at Naples for treatment. His enthusiasm in archæology and his example have been the inspiration of many, and have provoked the organization of societies in England, Germany, France, the United States, Greece itself, and other countries, for the exploration and excavation of the ancient Grecian sites. The enthusiasm, which carried him through all his life-work and permeated even his commonplace occupations and his amusements, was illustrated in his custom of giving Homeric names to all who came into his household. "Among his busy servitors," says Dr. Manatt, "were Æneas and Creusa; Bellerophon was his porter and Priam kept his garden, Circe and Electra were his handmaids. No matter what name one brought into his service, the chrism of the Hall of Troy made all heroic. His own children were Andromache and Agamemnon from their

birth—for short, Andromachidion and Agamemnonidion." When Dr. Manatt, accompanied by his daughter of seventeen, first visited him, he at once gave her a Greek name—Artemis—and that she remained to him to the last. At the first breakfast, "Artemis was installed in the place of the mistress of the mansion, and received the homage due to her illustrious new name."

Dr. Schliemann made his permanent residence at Athens, where he built a fine house which is styled a palace. Here, in the midst of trophies which he had recovered from the ancient world and "muniments of the world's honors," he led a methodical working life. "Hours before the Attic dawn, winter and summer, daily he was at the Phaleron for his plunge in the divine sea; all day long the busy work went on; and late into the night the lamp burned in the study that looks over the city upon the Acropolis." From any of his occupations he would turn to meet and entertain a visitor, and he was at home "of all men the most accessible." He dispensed a liberal hospitality, and on festival occasions his house was thronged by the best—the select of Athens and strangers. His business interests were never allowed to suffer. He had valuable investments in many countries, and they were all profitable; and he could find himself familiar at any moment with the details of their condition and management. His funeral was honored with testimonials from the Emperor of Germany, from the city of Berlin—which had honored him with the distinction shared only by Bismarck and Von Moltke, of making him one of its Ehrenbürger—and from numerous learned men and learned bodies, and by the personal attendance of the King and Crown Prince of Greece.

THE BADGER AND THE FOX.

OF the few animals which now inhabit the woods and the hillsides, perhaps the badger is the least known to the general public. He is nocturnal, in the first place; and his coloring, being in broken tones, does not readily arrest the eye. His head, chin, and neck are white, with brownish-black bands running on either side from the nose over the eyes and ears. His upper parts are light-gray sprinkled with black, the lower parts brownish black; his fore feet are long and stout, his limbs muscular, his jaw powerful, and his teeth sharp; in fact, he is well set up as far as these formidable weapons are concerned. The usual length of the animal is a little over three feet, but in his family, as well as in the human race, there are large and small individuals. Take his general appearance as he jogs along, and a small bear is at once suggested to your mind. Many of his ways, too, are bear-

like; he will lie up in the winter, and eat vegetable as well as animal food. Some other creatures, that are supposed to be strictly carnivorous, will eat fruit when they can get it.

The badger, poor beast! is getting scarce; more's the pity, from the animal collector's and the naturalist's point of view. He generally manages to dispense with the observation of the latter; for, unless his ways are well known, he will escape from a place that might have been supposed strong enough to hold a rhinoceros. All his family have been excavators from the beginning, on the most scientific principles. Unless you take the greatest precautions, he will dig himself out and get away in quick time. He is a most quiet and orderly being, and a contented one too, if let alone; for, as a rule, he is fat.

His persecutors are many, from the keeper down to the ratcatcher's lad, who boasts that he has "the best dog at any varmint as ever run on four legs." Some of our common expressions require alteration, being founded on ignorance. For instance, folks say, "Dirty as a badger"; whereas a cleaner creature in its home and surroundings would be hard to find. A very wide-awake individual he is; and he needs be, for the hand of both man and of boy is against him, and utterly without reason.

If the badger had but the same privileges extended to him that the fox has, he would not be so rare an animal as he is now. Why should he be so worried by dogs? It is to be hoped that badger-drawing has nearly had its day. This very practice, brutal as it is, testifies to his determined courage and fighting qualities; you could not find a more determined antagonist than he is when on his mettle.

With regard to his food, the greater part of it consists of such small deer as may fall in his way, when he wanders here and there in the evening after leaving the hole where he has lain dormant all the day. That long snout of his will poke and root out all manner of things, from a wild bees' nest to a field-mouse. He will eat young rabbits when he can get them, and old ones do not come amiss to him when the chance offers. A sporting character I knew once procured a fine badger for the express purpose of having him baited by all the fancy dogs in his locality. Among other creatures he kept rabbits, and his particular fancy was to have the very best of the lop-eared variety that could be procured. One doe he valued most highly, because, setting aside her own qualities, she had a fine lot of young ones, well grown, and as beautiful as herself.

The badger had only been caught the same evening on which it was brought to this individual. Not having a place ready for it, he placed it for the time in an empty hutch just over the one in which his favorite doe and her little ones were. Fastening the

door securely, he left the animal to his own devices for the night, little thinking what these might be. Next morning he found, to his horror, that the badger had torn up the floor of the hutch where he had been placed, and got into that of the doe, where he had slaughtered the whole family. Their bodies lay dead there, the badger curled up in the middle of them, fast asleep, and very full of rabbit. His first impulse was to kill the beast, there and then, but on thinking it over he remembered that he had paid a considerable figure for it; so he got the badger out and sold him to one of his friends as a pet, telling him that it was "quite harm-

THE BADGER.

less, would live on bread and milk, and in a very short time would follow him about like a dog." Very soon, indeed, he was requested by this friend to take him back again, but he refused.

I will describe one of his homes, which I have visited many times. At the bottom of a glade, by the side of the chalk hill, is a dip or hollow, not deep, but a kind of basin about twice the size of one of my living-rooms. Round this, old beeches, growing close by, have pushed forth their great roots in all directions; on one side of the hollow a gnarled oak stands, not any great height, but of vast bulk, the great limbs reaching far over the open space. In the middle of the hollow, under the roots of this oak, our friar of orders gray has made his home, and a very secure and pleasant one it is.

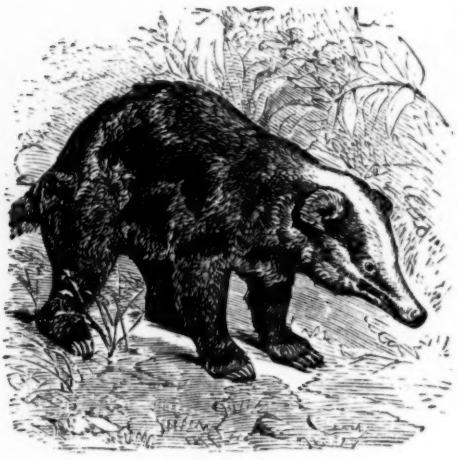
When the moon is high up in the sky, and throws a soft silvery blue tone on the tops of the firs which line the side of the glade, the glade itself showing like a bright blue-green stripe, and nothing is heard but the jar of the fern-owl as he flits over the glade, or the drone of some beetle as he flies along, then is the

time for our friend the badger to come out and see how the world looks in the moonlight.

He has left his hole, and there he stands in the full light of the moon, the great limbs of the oak throwing checkered shadows around him on the greensward and on the exposed surface of the chalk here and there. The greater portion of the sides of the hollow nearest his home is covered with foxgloves and trailing bramble. He looks round about him for a few seconds, and sniffs, just to find out if anything peculiar is in the air; then, finding matters all right, as he thinks, he gives himself a scratch or two and a good shake, and deliberately waddles off to get something to eat—a very easy matter at this time of the year, for on a warm summer night all kinds of creatures are about, and he makes their acquaintance much to his own satisfaction, if not to theirs.

Little does he think that he is wanted on this particular evening. While he goes plodding along, picking up a little bit here and there, the keeper and his lad are holding some conversation about him. I happen to come across them; my sympathies are with the badger, but it is not my business to interfere.

"Have ye got the bag and sack, Jim? If ye have, jest make yer way, quiet like, over t'other hill, an' cum down the side on it, on the quiet, mind; fix yer bag, an' when 'tis done, give three hoots, one arter t'other, to let me know as things is all right; ye minds what I tell ye; I'm goin' back to git Ginger an' Nipper. They'll hussle him up, an' no mistake. They ain't big uns, but better tarriers than what they be never cum inter this 'ere wurld. Now then, off ye goes, an' before ye gits yer job done I shall be near to ye, fur to hear ye hoot: he's sartin sure to be on the ramble."



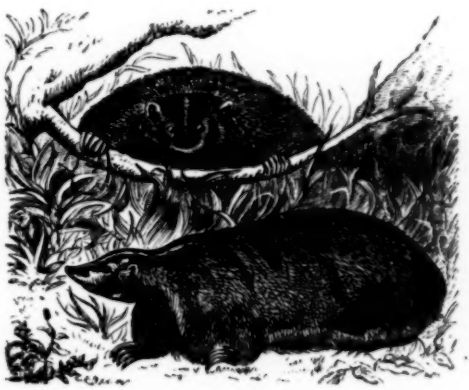
INDIAN BADGER.

Arriving at the spot, Jim produces the bag, or rather a small sack, from his jacket pocket, and places it in the entrance to the badger's burrow in such a way that should the animal rush for home, as he generally does when alarmed, he will go right into it. The string that runs round the mouth of the sack will be pulled tight by the force of his rush, and there he will be like a pig in a poke. The string of the bag is secured, of course, to

a peg. Having arranged all this to his own satisfaction, Jim picks up the large sack—he had two, a large and a small—walks out of the hollow on to the moonlit greensward, and hoots like a brown owl, three times. After this musical effort he stands quite still, and listens intently, but for some time the humming jar of the fern-owl, chur-chur-er-er-er-er-chur, is the only sound that reaches his ear. Suddenly he places his empty sack on the ground beside him, and is on the alert, for a sound of quickly moving feet at a distance makes itself heard. He knows what that means: Ginger and Nipper are close on the badger's track; and like the well-bred, well-trained little fox terriers that they are, they run him mute, save for the mere ghost of a whimper now and again, just enough to show they are eager to close with the poor beast.

That, however, is far from the keeper's intention; he would not let his two little beauties, game though they are, close with such a desperate antagonist as an old dog badger, if he could help it; for he knows well enough that dogs and badger would fight to the death. His plan is that they shall drive him to his burrow, and into the sack.

The best-laid plans do not succeed always, however, as is proved in this case. Nearer and nearer comes the sound of pattering feet at full speed, and behind that the heavy tread of a man who is putting his best foot foremost. Nearer they come; they will break into the moonlight in another moment; we can hear them pant, for they have run him through the cover at top speed. The lad is ready to dash down into the hollow; in fact, he has already moved to do so, when the sound of running feet stops dead; and then, in the thicket, a desperate tearing scuffle is heard going on, for Ginger and Nipper have run into and closed with him before he could reach home.



American Badger.

The sounds make Jim wild with excitement, and he shouts his loudest to the keeper, who is now close at hand and puffing like a steam-engine with running so hard.

"Can't ye git a badger in a sack without hollerin' like murder?" he asks angrily. "I'm a good mind—'

What he'd a good mind to did not transpire, for the boy yelled out: "I ain't got him; they'se got him; don't ye hear 'em worryin' of him?"

Making use of some very strong expressions, such as he would not make use of at a chapel tea-meeting, the keeper dashes into the thicket, followed by Jim; quickly they reach the spot, where they see a confused mass of living matter, turning and twisting, growling, whining, and snapping, at their feet.

"I'll murder ye, you old varmint!—Look out, Jim! Cuss an' hang him! I can't git a stroke at him! Why the —— here they are; what's up now? Ginger! Ginger! loose him! Ginger! he'll rip ye up in bits. Let me smash him!"

"Here he is; hold hard, master! ye nearly had 'im; hold hard!"

"Well, if ever I take my tarriers! Oh dear! oh dear! if there ain't Nipper; he's done for. Hold him, Jim; don't ye let him out o' yer arms, for mercy sake. Now, then, here they are; now fur it, one way or t'other. This is the wust night's work as ever I come across. Jim! Jim! where be ye?"

"In this 'ere tangle; I'm comin' fast as I can."

"Have ye got Nipper?"

"Yes, I got un."

"He's a dunner, ain't he?"

"No, he ain't; it's tight work fur me to hold him!"

"Don't ye let him go; here they be, dead as herrins! Oh dear, Ginger! if I ain't wound up clean! Never agin will I see your feller. If it waunt fur the shame on it, I could fairly beller! I be cut up, an' no mistake."

"Pick him up, master! you'll hev to loose his holt, for dead as he be he's got him under the ear. This 'ere night's work about winds my pig up, I can tell ye."

Picking Ginger up, and holding him in his arms, the keeper stood in silence. Presently a slight movement took place in the body of the terrier, and with a low whimper and one long-drawn breath he opened his eyes, and then licked the face of his master.

"Jim! hoora! houra! Ginger's alive; oh, my precious Ginger! oh, ain't you tore about! Give us Nipper, an' shove that cusnation warmint in the sack, an' let's git back fur to doctor these 'ere poor things. We'll git 'em round, if 'tis to be done.—Look 'ere, Jim, did ye ever? they ain't hurt much; they're tryin' their werry hardest ter get out o' my hands ter hev another go at him! I don't think as there's sich another pair o' tarriers as these 'ere two, no, not nowheres: there can't be! Ye've got that murderin' warmint?"

"Yes, he's in the sack."

"Then look sharp! we'll cut out o' this; come on! an' next time as master wants a badger fur one o' his friends, somebody else's tarriers 'll hev to drive un. The fust one as we got out was that old warmint's missus an' her cubs. That was a diggin' job,

as we wunt forgit in a hurry; 'twas desprit work. But this 'ere bit o' business sets that aside clean. Jim! what are ye sniggerin' about? what's in the wind now, ticklin' yer fancy that way?"

"Oh, nuthin' pertickler. Is Ginger an' Nipper quiet?"

"No, they ain't; I thinks as they'd like ter fall foul o' that 'ere sack."

"Well, I dessay they wud; fur this 'ere warmint has cum round agin', an' is tearin' an' scratchin' like mad. It do take a lot to wind a badger's clock up, that it do!"

"Jim, when we've sin to the dogs, you come up an' hev a pint o' the best cider."

THE FOX.—I feel it almost presumptuous on my part to say anything about that wonderful animal, the fox—so much has been written and said about him, both by sportsmen and some of the greatest of our literary geniuses. My account of him will be

ENGLISH FOX.

brief; not having the fox-hunter's feeling of veneration for him, nor the hatred natural to the poultry-keeper, my views will at any rate not be one-sided. Nor have I ever had the least wish to possess Master Reynard embalmed as a mummy, or to see the wily gentleman in a glass case, lean and hungry-looking, with squinting cunning in his eye. He is known to me as a clean, swift, strong, and handsome creature, full of courage. He is also universally credited with a very large amount of intellectual power, although it is always said to be employed exclusively for his own benefit. To call an individual of the human family an old fox is certainly not a compliment, for it implies that he is crafty and selfish.

His usual length is four feet, but he varies in size according to food and locality. In the Highlands of Scotland he is *almost* like a wolf in size and strength; and he is not regarded in the same light as in England, for he is shot down without the least compunction there. The proper place to see all wild animals to

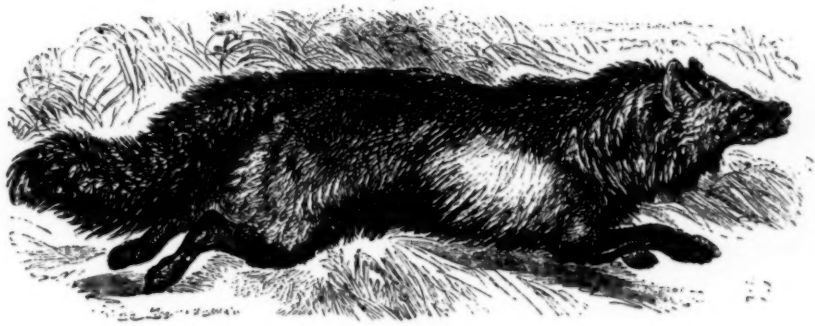
advantage is in their own home. May I be allowed to say that, in this respect, they are unlike many individuals of the human species?

It is just after four o'clock on a soft May morning, and the sun lights up the tops of the trees, bringing the tender foliage out in sparkling relief against the hill-sides. At the foot of the one nearest us Reynard and his vixen partner have their home. Numbers of fine beeches grow here; the chalky soil is well suited to them. A large one has been blown down at some time, but it has been sawn from the roots long ago. For a long distance the soil was loosened in its fall, and Reynard has taken advantage of this to form an earth for himself and family among the loosened chalk, stones, and old tangled roots. The surface round about is covered with the finest and greenest turf. Many hawthorn bushes are there, giving out their delightful fragrance to perfection, for the morning is warm. On the end of a long beech bough, which reaches far out over the earth, a cuckoo sits and flirts his tail about, shouting, "Cuckoo! cuckoo!" The entrance to the earth and a small space about it is bare, for the little foxes are playful animals, and are at high jinks often, capering about. At present they are, comparatively speaking, quiet, for all their bellies are full. Father Reynard is sitting in the bright warm sunlight, winking in a most knowing manner, while two of his cubs play with his bushy tail to their hearts' content, tossing it from one side to the other in a most comical fashion. Mother vixen has a rabbit in her mouth, which she tosses up and catches, and then lets drop for one of the young ones to nibble at its ears, while the darling of the family torments a poor frog that has found his way there. The whole lot look as though they had a touch of dropsy, their bellies stick out so. The feathers and feet of pheasants strew the ground, and other remnants, for Reynard's motto is: "Other creatures' young ones can cry for food if they let 'em; but mine don't, if I know it."

At some distance the alarm note of a blackbird sounds. Reynard opens his eyes, pricks his ears, and the cubs leave off playing with his tail. The next moment a jay squeaks out, and comes flying overhead. That is enough; he is up on his feet, ears erected, eyes gleaming, and his brush held almost in a line with his back, his fore feet well to the front, the hind ones on the spring. Squeak! squeak! and another jay flits past. With a rush the cubs dash to earth, followed more leisurely by their worthy parents. The cause of their stampede is soon explained, for up the side of the wooded slope a man is seen coming; it is the keeper on his early round.

Reynard is very accommodating as to his food; nothing nice comes amiss to him: game of all kinds, furred and feathered; fish,

when he can get the run of them in spawning time, when they are on the sides of the shallows; field-mice, and his especial dainty, a well-fed barn rat. There is no lack of these in the harvest time, and up to the commencement of the winter months. Then they troop back to their old quarters for the cold season. He has a taste for poultry; ducks he values most highly. Perhaps no one but a miller would expect to find a fox in a swamp; but he knows his tricks and likings, and, though he curses him most heartily, yet lets him go free, for is he not St. Reynard? The miller's landlord hunts him in the orthodox manner.



American Fox.

On the tussocks, covered with flag and rush spread all over the swamp, the fox makes a most comfortable retreat. Getting into the middle of one, he twists himself round and round, dog fashion, and there he lies on a nice bed, soft and dry, completely hidden from view, remaining there until the miller informs his landlord's keeper that a fox is there; then the huntsman comes round—and the sooner he does this the better, or there will not be a duck left on the pond.

Reynard can hear them nozzling and softly quacking at the edge of his hiding-place; with cat-like steps he creeps closer, looking through the flags. When he finds that he is near enough for a jump, there is a splash, and one low quack and the drake is in his mouth. In pictures you may see him represented with his quarry slung over his back. This is not correct; he carries what he has caught in front of him, like a retriever. More than once, when in search of wading birds, have I come on the retreats of the fox and the otter very near to each other. For cool impudence, match him if you can. I have known a dog fox, when the vixen had the care of a family, enter the yard of the keeper's house, take one of his game hens from under his living-room windows, march off with it across the road and to his home, give it to his family, and then come back for another. A pointer was in the yard at the time, chained to his kennel. Driven off at his

second visit, he coolly recrossed the road to the turf, squatted on his haunches there, and looked over at the yard and the game hens used for hatching out the pheasants' eggs. It was too much for the keeper to put up with. Slipping a cartridge into his gun, he swung it up to his shoulder and let drive at the fox, saying, "There's notice to quit, you thund'rin' sweep!" Then did Master Reynard play some extraordinary antics. First he jumped off the ground several times in the most lively manner, then he cuffed his ears vigorously with his fore feet, gave a bit of a yelp, and bolted at top speed. His skin is thick, and what would knock other things over would not cripple him.

ARCTIC FOX.

When the hunters and the hounds chevy him across the fields honest farmer Giles complains most bitterly. "Dash my old gaiters, if I doan't wish as every warmint of a fox as ever run was cold and stiff; that I do; an' 'tis a pity as some folks ain't got better work for their hosses than ridin' over other people's craps an' breakin' fences an' gates. 'Tis wonderful what a likin' most of 'em have fur blunderin' thru a fence an' knockin' the padlock off a gate. Why doan't they jump over 'em? ef their hearts was as big as their hosses hap they wud. That there field of turmits will be punched inter sheep feed, they wunt want to go inter no cuttin' machine. Cuss all fox-huntin'! I sez; 'tis ruin for farmers!"

It was wonderful how quickly farmer Giles was brought to modify these strong opinions on fox-hunting by the appearance of a two-gallon bottle labeled Old Irish, "with the Hunt's compliments." He uncorked the bottle, smelt and tasted it more than once, with and without sugar, ejaculating between each sip, "Massy, oh alive!" Then he walked to those fields again over which they had ridden. Could it have been the softening influence of the Old Irish, or had he been making mountains out of molehills? for when he got back he told his "missus," with a beaming smile of benevolence on his face, that, "raly, considerin' the lot o' gentlemen as 'ad rid over the craps, the little harm as he cum across waunt wuth speekin' on."—*Cornhill Magazine.*

RACE INFLUENCE AND DISEASE.

By G. BERNARD HOFFMEISTER, M. A., M. D.

IT has been my lot to deal professionally for some years with people of divers colors and races, nations and languages in many different parts of the world, and in varied and constantly changing climates. I have thus had exceptional opportunities and sufficient leisure to ponder over racial variations as they present themselves to the medical eye.

Perhaps the most interesting races with whom I have been thrown into contact are the African, and I will consider them first. I have more especially had to do with the natives of East Africa, who are Mohammedans of a somewhat lax and unorthodox type, and yet, owing to their implicit acceptance of Mohammed's fatalistic doctrines, their submission to *kismet* is so complete as distinctly to influence the course of their illnesses.

Indirectly it does so in the following way: When a Sidi-boy incurs, for instance, a wound on his leg, he thinks that if Allah wills that this should get well its healing is certain, but, if the divine wish is otherwise, no human skill or care can do one iota of good; on this account details of simple dressing and protection are quite neglected by this poor fellow, or as much so as the surgeon will allow. If under discipline, he is willing to have his name on the sick list for the privileges which belong to it; but in his heart he despises surgical treatment. Clearly, then, the prognosis with such a case is much worse than it would be in other subjects.

The same argument applies with much greater force to medical cases, on account of the childlike ignorance which exists among such people as to what disease actually means.

This extreme and apathetic dependence on fate forms the greatest difficulty with which the physician has to contend. It speaks well for the blind religious faith of these races, and puts to shame many professing Christians on their sick-beds; but it costs many lives, and entails much extra work on medical attendants, who have perhaps to administer remedies with their own hands, and that often under great difficulties and at much personal sacrifice.

Another more direct point, and one which adds to the gravity of the prognosis, is that these men are not at all anxious to recover; their idea of the value of life is very low, their present existence is usually a hard one, while their religion promises them better times in their heaven, so that if Allah wills to take them they are in luck, and by no means to be pitied.

Now, we all know what it is in the crisis of a severe illness for

a patient to have pluck, and a sufficient supply of doggedness to be capable of making a continued effort; to make up his mind in his saner moments not to yield to the sinking feelings that *will* come over him, to fight against his illness as against an attacking enemy, to feel that he is *determined* to pull through, if only to please his friends, to spite his rivals, to foil his foes, or to accomplish some non-completed task. I remember to have had somewhat similar ideas in my own maladies, and I feel sure they were of much assistance to my recovery.

Such impulses as these from the organs of thought and will must of necessity have a distinct effect upon the rest of the nervous system, and thus over the heart and other organs, if only through the emotions, and that a beneficial and stimulating effect; these impulses may therefore make all the difference in tiding over a crisis, and during early convalescence. But of course the influence of the mental state upon disease is unquestioned. The absence in these races of this important factor, and the presence of the stagnating fatalism above mentioned, are, I feel sure, the causes of many a death.

One of my first cases, and it taught me a great lesson, was that of a stalwart East African who complained of feeling ill; on examination nothing could be found amiss but slight febrile symptoms and a small patch of pleuritic friction. To my surprise, the poor negro began by saying he was going to die; he went to his bunk, and next day I found him much the same, except that the heart's action was rather enfeebled, though no physical signs of cardiac disease could be detected. He was, however, utterly uninterested in his condition, and only took food under compulsion. In the evening he suddenly expired, more as it seemed—for I was unfortunately unable to make a *post-mortem* investigation—from what I might call *inertia* than from his actual disease. Later experience told me that had I bullied the man, and given him brandy with my own hand, and stirred him out of his apathy, I might have saved his life. But it was often noticed among us that if, on becoming ill, these men predict that they are sick unto death, they will, if left to themselves, simply go and lie down and quietly die, refusing all assistance.

Confirmation of this view is found in the following words of Hume Nisbet, when speaking of similar races:

"When hope ceases to glow in their breasts, or a superstitious omen tells them that they are to die—it may be the word of the magician, or the bone pointed at them, as among the Queenslanders, or the lizard running over them, as with the Maori, or the utter weariness of life taking possession, as with the Sidi-boys—they can lie down and give up life as easily and methodically as they fall asleep.

"This will-power is utterly beyond the comprehension of us Westerns, nor can doctors give the complaint a name; sailors say they die out of 'pure cussedness.' A Maori will count up the days he has to live, inform his friends of the fact, and die up to time; he calmly lies down and dies without an effort."

So much as regards the course of diseases; now as to treatment. The most successful means of treating such cases lies in the use of alcohol, and so unaccustomed are most of these people to its action that very small doses are required to produce a good effect. It acts partly by a kind of intoxicating influence, putting a little energy, or even "devilment," into them. If administered with cautious judgment, this support may be kept up until convalescence is fairly established, when with returning strength they realize that destiny means them to survive; here the ordinary good effects of stimulant treatment are much enhanced by the previous abstinence.

It is well known how very excitable are these woolly-haired, thick-lipped, flat-nosed races, the excitement representing the opposite mental condition to the extreme languid depression of which I have already spoken. For instance, at the great *Mohurram* festival at Bombay, which I once witnessed, I noticed that all the noise and mad dancing and boisterous fanaticism of the night processions were manifested, not by the natives of India, who were in a large majority, but by the negroes, their religious fervor and the frenzy born of *bhang* conspiring to excite them. It is this sensitiveness to rapid mental change that gives alcohol such potent virtues with them in sickness.

The natives of our Eastern empire, always excepting the fine Sikh races, and those living near the northern frontier, than whom I have never seen finer or braver specimens of mankind, are people of poor stamina, and are easily prostrated. Timid and feeble, they dread the pain of illness, and dislike the thought of death mostly on account of the ordeal of the dying process. They are therefore ready, nay, over-anxious for medical treatment, and are fond of both liniments and physic. But in spite of this they fare worse than the Europeans in all ordinary diseases; symptoms are more severe if less sthenic, prognosis is graver. Some explanation may be found in their habitually poor diet, which leaves little balance to the credit account in the nutrition of the tissues, and consequently small resisting power to disease, but more, I think, belongs to a want of "real grit" among them, a characteristic racial failing.

For example, a catarrhal condition of the alimentary canal will pull such a patient down with alarming rapidity, out of all proportion to the other symptoms, and indeed often to a fatal ending. Stimulants in such cases are, of course, of great use, but not to

the same extent with our Aryan brother as with the Africans. With small abrasions and ulcers healthy granulations are the exception, lymphatic abscesses are a frequent result, and belong to a low phlegmonous type, pyæmia often supervening. Perforating ulcers of the feet and gangrene about the toes bear evidence to a poorness of local nutrition, and a low vital tone of some of the tissues, also shown by the fact that necrosis of bone is a much more frequent sequela to blows than with hardier nations.

Another point that I have noticed is that minor ailments, such as coryza, etc., take a much more severe course than that with which we are acquainted.

Both the Indians and Africans are much less subject to ill effects from changes of temperature than are Europeans. This is perhaps to be expected in tropical climates, and may be due to the excellent way in which their sweat-glands respond to an extra call upon them, consequent probably on their scantier clothing and less constant interference with the natural skin-functions. Also, in spite of their thin cotton garments, sudden and temporary exposure to a winter climate produces a very small percentage of sickness among them, though those who do suffer become really ill. True, they grow torpid and incapable of much work; but, if Europeans were exposed as much as I have seen these darker races, I feel sure a very much larger proportion of them would soon be on the sick-list.

Chinese and Japanese make much better patients. They have faith, want to recover, and endeavor to do so. They are fairly tractable and obedient, their average constitution is more robust, and they are not destitute of moral courage; consequently treatment yields in their case better results.

Among European nations I have been much struck with the difference in the course of sickness between the Teutonic and the French people. For instance, I have witnessed the effects of extreme heat in the Red Sea, through which I passed seven times in a single year. The phlegmatic German, from sheer stolidity, stays exposed to the sun until he feels queer, then comes below and takes a large draught of beer, which, of course, makes him much worse. His condition soon becomes one of typhoid delirium bordering on stupor, but he is easily treated, and soon recovers. Now, look upon the other picture. The fussy Frenchman, from rank obstinacy, exposes himself to a high temperature, and on feeling ill becomes at once fearfully alarmed, wants to try every remedy at once and nothing long, blames every one but himself, grows noisily delirious, and finally works himself into a state of extreme exhaustion which materially adds to the gravity of his case.

The above personal observations have led me to search out

evidence to support my views on the subject, and I now append a very brief account of what I have found in reference to particular diseases, specific and otherwise.

INFLUENZA.—Isolation for long periods from other races, as in the case of insular populations, causes influenza and similar epidemics to run a more severe and dangerous course; witness the cases of St. Kilda and the Society Islands. An epidemic takes place when the infecting visitors are afflicted with apparently only the slightest of colds, while less recent arrivals, if attacked, suffer far more lightly than do the older inhabitants, though more so than the visitors themselves. During my stay at Ascension Island I was told by a resident official that a cold introduced from a passing vessel runs through the island as a severe epidemic, necessitating rest in bed and active treatment for several days. This effect is still more virulent, leading even to fatal results, in the island of Tristan d'Acunha, where the isolation is much more complete, and the people are of British origin.

Now, sea-water is by no means the only method of isolation, and in earlier ages, situation, feuds, and scanty means of locomotion were efficient causes. When a tendency to a particular complaint becomes increased by long periods of isolation, so that heredity is able to accentuate any special proneness, one possible explanation of the origin of pathological racial idiosyncrasies is afforded.

DENGUE.—African races incur this disease much less frequently than do others, and with them it takes a very mild form, being highly amenable to expectant treatment and simple care. On the other hand, the natives of India suffer in greater numbers and much more severely than do Europeans even, and show a much higher death-rate from it. Now, there are many African immigrants in India, and *vice versa*, yet this racial law still holds good among them, even after some generations.

SMALL-POX.—Both the negro and the Arab tribes in the Nile regions of Africa, and also the Aryan races of central Asia, have from time immemorial suffered cruelly from variola. Vaccination has lessened the value of comparative statistics on this point, but the mortality from the disease has been and is positively awful, complete depopulation sometimes resulting in particular valleys or islands.

MEASLES as an epidemic has caused terrible devastation among insular races, especially in warm climates, assuming a far more virulent type than that known to Europe, among people less capable of resisting a panic-creating disease.

MALARIA.—Here occur the best instances of acclimatization of races. Ethiopians are affected less frequently than are other peoples, and with diminished severity. Blonde and blue-eyed Euro-

peans, as with gonorrhœa and some other complaints, furnish the worst victims. As regards its treatment, quinine has far less efficacy with them than with us, and arsenic is more of a specific remedy to them, though this depends on the actual variety of the fever. With the negro, after-effects upon the constitution are quite exceptional.

YELLOW FEVER.—Special liability and increased mortality belong to the light-haired Europeans, and acclimatization is by no means absolute; yet pure-blooded negroes possess congenital immunity, which is certainly absent from Redskins, or Hindoo coolies, though the Chinese are almost exempt.

CHOLERA.—The African races incur the greatest danger from this dread disease, dying off without an effort at resistance and with the greatest rapidity, giving little opportunity for treatment. Europeans and Hindoos, however, provided the latter are under fair hygienic conditions as to food, etc., suffer very similarly. After a famine the Indians, deprived of all resisting power, fall ready victims.

TYPHOID FEVER gives a typical instance of acclimatization of race through heredity, for in tropical regions the disease is often completely limited to strangers. During my visit to Jinjeera, off the Malabar coast, I was informed that the foul water of the large "tank" is certain death to a European through this fever, and yet it forms the ordinary drinking-water supply of the crowded inhabitants. Among such people mild cases, due probably to the same poison exerting a much mitigated action, are, however, not infrequent. In this instance time has apparently produced a modified form of the disease by a general protective process of natural infection, similar in its effects to inoculation, as well as by the all-pervading action of natural selection and accommodation to environment.

LEPROSY is well known specially to select tropical races, and to run a more rapid course with them.

SYPHILIS punishes negroes of the coast of Africa often and very viciously. Phagedæna forms an ordinary complication, as also does bone-disease; and specific treatment has to be pushed with perseverance. On the other hand, the central Africans are remarkably exempt, as are also Icelanders and Greenlanders. In Chinese ports Europeans suffer extremely when compared with the natives, as if the poison, like other living species, had its varieties. Perhaps, too, an inherited natural inoculation becomes a protection to particular races.

BRONCHIAL CATARRH for some reason, it may be carelessness as to clothing and dwelling, inflicts greater punishment on indigenous dark races than on strangers among them, runs a much more trying course, and is more resistant to therapeutic influence.

PNEUMONIA.—Natives of the tropics, and more especially negroes, whether at home or abroad, are peculiarly subject to this acute fever. The death-rate and average of severe cases are among them exceptionally high.

PHTHISIS is also remarkably rapid and frequent with these races when sojourning for many months in cold climates, but less so with the southern Asiatic.—*The Practitioner.*

SCIENTIFIC JOTTINGS IN EGYPT.*

BY DR. H. CARRINGTON BOLTON.

THE following pages record impressions and observations made in the spring of 1889, during a brief sojourn in the Nile Valley, and a more deliberate study of the Sinaitic Peninsula. In discussing one's experience on a journey the weather claims early notice. In February, at the hotel in Cairo, the thermometer ranged from 60° at 8 A. M. to 78° at 3 P. M.; but on the Nile steamer much greater extremes were noted, 54° at midnight (February 19th) to 87° at 2.30 P. M. (February 9th). In the shade the heat was rarely oppressive.

The temperature in the desert in March was favorable to the traveler's comfort, with rare exceptions; the thermometer ranged from about 60° to 80° in twenty-four hours at the sea-level, and from 48° to 75° at the elevation of about five thousand feet.

The highest evening temperature was on March 17th, after the *khamsîn* had blown all day—at 7 P. M., 84°. The lowest temperature observed was on March 20th, in camp about three thousand feet above the sea—at 6.30 A. M., 33°. (In February, 1874, Rohlf noted in the Libyan Desert a minimum temperature of 23°.) In considering the physiological effects of these temperatures one must remember the extreme dryness of the atmosphere in the desert.

My first experience in Egypt was calculated to give the impression that it is a rainy country, for I saw two showers in three days. In passing through the Suez Canal (January 31st), a heavy shower, lasting half an hour, drove the passengers to shelter, and a brilliant rainbow delighted beholders. Two days later, rain again fell at night in Cairo, making the dirty streets more nasty still. Of course this experience was exceptional, as rain is a rarity in Cairo. Authorities give the rainfall at Alexandria as about eight inches per annum, and at Cairo about

* Abstract of a paper read to the New York Academy of Sciences, February 24, 1890, and condensed by the author from the Transactions, vol. ix, p. 110.

1·2 inch, while in Upper Egypt the precipitation of moisture is far less; there are adults who say they have never seen rain.

I noticed, on the other hand, unmistakable signs of recent rains, such as dried mud-puddles, rain-drop prints, etc., at several points, near Cairo, east of Thebes (Wadi Bab-el-Molook), and in the peninsula of Sinai, and I was impressed with the belief that more rain falls in Egypt than is usually supposed. A local shower passing over a sandy, gravelly region, makes but little impress on it; and there is no corps of trained observers, outside of Cairo and Alexandria, to record the phenomenon. On visiting the Khedivial Astronomical Observatory just out of Cairo, I was cordially received by the director, Mr. T. Esmatt, a graduate of the École Polytechnique of Paris, and for three years an assistant in the Naval Observatory at Washington. I take pleasure in mentioning his politeness and courtesy, but I can not omit pointing out a weakness: he took me to the roof of the building to see the meteorological instruments, and I noted that the rain-gauge was quite full of water; this again gave me reason to regard Egypt as a rainy country. (The last shower fell one month previously.)

During my journey in the desert (March 13th to April 8th) rain fell three times in my vicinity: twice the fall was insignificant, lasting only two or three minutes, but on March 19th rain fell abundantly in Wadi Feirân, from 7.15 A.M. to 9.30 A.M. Heavy mists had obscured the peaks bordering this extensive valley nearly all the preceding day; the temperature during this rainfall was 52°, elevation about nineteen hundred feet.

That heavy falls of rain and even of snow occur in December and January in the Sinai region, is reported by many travelers; in the defile of Nakb-el-Hawi (five thousand feet), crossed by pilgrims *en route* for the sacred mountain, the winter rains make veritable torrents; in 1867 the water rose to such a height in the valley adjoining, Wadi Selâf, as to wash away a camp of Bedouins, causing a loss of forty lives and of numerous cattle (Baedeker). Captain Palmer describes also a sudden precipitation so copious as to fill the bottom of Wadi Feirân to the depth of several feet, causing the party to seek high ground. That the Oasis of Feirân was once the site of a village of anchorites and monks sufficiently important to become an episcopal see, is known to students of history; this was in the second to the sixth century A.D. A few cut stones, the capital of one column, and ruined sites, alone remain to indicate the locality.

Powerful winds sweep across the plains and through the valleys of Arabia Petræa, with a violence and continuity that I have not elsewhere experienced. In the spring months the prevailing wind in the desert is from the north and northwest, down

the gulf. This wind is a cool one, but it occasionally veers around to the south and becomes oppressively hot. In April and May this south wind, called *khamsîn*, blows unremittingly for days together, scorching the traveler's skin and filling the orifices in his head with a very fine dry dust. *Khamsîn* is from an Arabic word meaning fifty, so called from a mistaken notion that it blows for a period of fifty days before the summer solstice.

In the Nile Valley, north winds prevail during the heated period of eight months, and southern winds during the rest of the year; these being in the opposite direction from the winds in the region of the Red Sea.

I witnessed three characteristic sand-storms at localities far apart and under varied circumstances. On February 15th, when riding a donkey through Thebes Nileward, a powerful west wind arose in the afternoon, blowing before it fine dust from the Libyan Desert. Words fail to describe the discomfort of such a sand-storm; the fine dust seems able to penetrate everything except perhaps an unbroken egg, and it is quite impossible to escape from it; to prevent suffocation, I borrowed from a fellah a coarse yet closely woven blue outer garment and wrapped my head up. Donkeys did not seem to enjoy the phenomenon any better than the Bedouins, and they shrank from its blast as well as the travelers. After crossing to Luxor in a boat, we found the residents in the large hotel much inconvenienced by the penetrating dust, although the building is screened by a handsome garden.

My second experience was in Cairo itself. On March 6th a northwest, and consequently a cool, wind blew dust from the adjoining desert into the city with such power as to obscure the usually brilliant sun during an entire day. Residents of Cairo said that the sand-storm was the severest in twenty-five years, and of an unusual character—being accompanied by a low temperature instead of the scorching *khamsîn*.

I experienced a third sand-storm in the desert of Sinai, on the plain of El Markha; it was accompanied by a scorching south wind, and the drying effects on the skin and the capital orifices produced greater discomfort than the suffocating dust and cutting sand; my party could do nothing but sit in silence on our camels, facing the storm, and the poor animals forgot to snatch at the tufts of scanty shrubs, as is their custom. In the evening the fierce wind very nearly overturned our tents in spite of extra stays, and at dinner every course was seasoned with the all-penetrating dust. The temperature at 7 P. M. was abnormally high, 84°; just twenty-four hours later it fell to 58°, the wind having meanwhile veered around to the north, bringing with it heavy mists.

Before dismissing the subject of climate, I wish to testify to the invigorating, delightful air in the desert; it has a bracing quality that enables one to expend much energy without fatigue. From about 1 to 3 P. M. the glare of the sun is often great, and shade is a comfort; but the constant breeze, sometimes rather too strong, tempers the heat. I suspect, too, that the air is very free from disease-germs.

In the journey from Suez to Sinai by the ordinary caravan route, one crosses undulating plains, limestone and sandstone hills, and eventually reaches bold granitic mountains, rising to the height of eight thousand feet. Each of these regions is furrowed by wadis, or dry water-courses, which present very different aspects in the three divisions named. The first fifty-two miles of the journey, occupying about two days and a half, as camels travel, cover an arid, sterile plain about ten miles wide from the low range of limestone hills on the east, Et Tîh, to the gulf on the west. This plain, like that of El Gâa, to the south, rises gradually from the sea to the foot-hills, and is undulating toward its southern end. It is crossed by broad, shallow wadis, running east and west, which were perfectly dry at the time of my visit; Wadi Werdân, the largest, is depressed but a foot or two below the level of the plain, and is approximately three miles in width at about six miles from the point where it enters the sea.

The most extensive plain on the western side of the peninsula is that of El Gâa, which is about eighty miles long and fifteen wide at its widest point. From the sea-coast to the mountains bordering it on the east it rises nearly one thousand feet, but so gradually as to deceive the eye and appear level. It is crossed by many shallow wadis, and its northern half is separated from the sea by a range of limestone hills (Jebel-el-Araba) reaching a height of sixteen hundred feet. When the plain was covered by the sea, this range was probably an island, or series of islands. The plain is rarely broken by hills, the sharp-pointed Krên Utûd, conspicuous from a distance, being an exception. I crossed the monotonous desolate waste, from the mouth of the beautiful Wadi Es-Sleh to Tor (or Tûr), on the gulf, a distance of about fifteen miles, and noted scarcely a dozen tufts of plants; water is absolutely wanting. North of Tor, however, and east of Jebel-el-Araba, are palm-gardens that extend for several miles in a narrow belt; and these date-bearing trees owe their existence to several saline springs occurring at intervals, some of which were quite warm. On this sterile plain the characteristics of a desert are seen in perfection: the level expanse is not too broad to conceal the lofty mountains on the east, nor to prevent glimpses of the blue sea on the western horizon; the floor is a firm, hard surface, made up of a compact mixture of gravel and coarse sand, so hard

indeed that camels make no impress on it with their broad feet. At some places the surface pebbles are of many shades of brown, intermingled with black and white, and these are so closely laid and regularly distributed as to resemble a mosaic pavement, but of course a patternless one. The surface particles are generally coarser than those immediately beneath; they are chiefly limestone, sometimes of coralline limestone, intermingled with flint and other varieties of amorphous quartz. Many of the pebbles show on their surface beautifully regular pittings and furrows carved out by the wind-driven sand. The fine-grained sand has all been lifted high in air by the powerful winds, whirled away, and dropped into depressions or on the lee sides of hills. Hundreds of acres have no surface stones larger than an ostrich-egg; no water whatever is found in this region, much less any signs of vegetable or animal life, rarely even a passing bird.

On this desolate plain, when overtaken by night, one place is as good (or bad) as another for pitching the tents, unless perhaps a small hillock is reached, which may serve as a partial shelter from the gales that sometimes threaten to overturn the canvas.

In the region of extensive plains, the wadis, or dried-up water-courses, being depressed but little, closely resemble them. The floor of the wadi hardly differs from that of the plain, except when a torrent has swept before it large bowlders and deposited them irregularly in its bed. The sorting power of the water, however, is noticeable, as also the well-defined vertical walls, perhaps only a few inches deep, excavated at the point of lowest level. On the margins, too, of the wadis of the plain, and at points protected from the full force of the winter floods, several varieties of green shrubs grow in widely separated tufts. I often remarked mud-cracks, apparently of recent date; but these indications of water probably remain undisturbed in this desolate region for a considerable period, perhaps for several seasons.

In the limestone hills these wadis take the form of cañons, having nearly vertical walls, sometimes hundreds of feet high—as in Wadi Tayyibeh. The regular erosion on their sides produces, often, picturesque effects, as at Ras Abu Zanîmeh.

In the granitic district the wadis form V-shaped valleys, broken by narrower ones entering at right angles, and bounded by bold peaks many thousand feet above the beholder. In the beds of these wadis are scattered specimens of the rocks of the surrounding country; often bowlders of great size testify to the violence of the torrents during the winter months, especially in Wadi Feirân.

The absolute dependence of the population of Egypt upon the Nile is a familiar fact, discussed from the time of Herodotus to

the present day. The proposed reopening of Lake Mœris in the Fayoum district, for irrigating the Delta, has been fully explained to the Academy by one of our members, Mr. F. Cope Whitehouse, its enthusiastic advocate.

The conditions of occurrence of water in the desert are perhaps less familiar. Not only is water scarce, but when obtained a large proportion of it is practically unpotable, being saturated with saline matter to such an extent that the soil in the vicinity is white with efflorescent salts of soda, magnesia, and lime. The "bitter waters" of Marah are not exceptional. The longest journey that I made without meeting good drinking-water was on the return from Tor to Suez, a distance of about one hundred and fifty miles, occupying six and a half days. On this route we passed a well in Wadi Gharundel where camels and Bedouins slaked their thirst, and our water-barrel was replenished with water for washing; but had we not been supplied with sweet water from the Nile, brought down to Tor on a boat from Suez, we should have fared badly in this respect. At the time of my visit all wells were admittedly very low, and in some places entirely dried up; so I saw the region in its most arid aspect.

Good water, flowing from springs and running short distances —say a quarter of a mile before sinking into the thirsty soil—is found in Wadi Feirân and in Wadi Tarfa. In the former place, many date-palms and even barley-fields make a charming oasis; at the latter, palms, canes, and tamarisks line the babbling brook, as it may truly be named, but the oasis is not extensive. North of Tor, on the gulf, are flowing springs of warm and saline water, not very palatable, but admirably adapted to the culture of date-palms, of which there are many thousands. The best drinking-water in the region that I have visited is on the flanks of Sinai. There are four wells within the monastery walls, one without, and others in the Leja Valley and vicinity.

In Wadi Es-Sleh, the romantic gorge southwest from Sinai, I discovered a cold and sweet sulphur spring, agreeable to the palate. It issues in the center of the wadi, at a point two hours' journey east of its mouth, and flows a short distance, depositing characteristic bluish sulphur on its borders. It was this latter that first attracted my attention. This spring is not mentioned in Baedeker's guide-book, generally so accurate.

The total absence of ponds and lakes is a marked feature in the physical geography of the peninsula of Sinai. Rain does at times fall in abundance, but it rushes precipitately down the wadis into the seas which bound it on two sides. Yet there is evidence of the existence of lakes at some earlier period. In Wadi Feirân, banks of earth sixty to one hundred feet high rest on the mountain-sides, especially in the angles of the valley, showing clearly

the former existence of a lake, the barrier of which was probably near Hererât. I noticed also, at the point where the Wadi Es-Sleh enters the plain of El Gâa, unmistakable signs of an ancient lake. The wadi emerges suddenly from the mountain-range, and a circular depression from thirty to fifty feet deep, with a perfectly level sandy bottom and bounded by nearly vertical gravel cliffs, now marks the bed of a small lake.

The uninhabitability of the peninsula is due to its sterility rather than to its climate. Its sterility is due, I imagine, more to the unequal annual distribution of the water than to its absence, and, should the population warrant it, storage-dams, easily constructed in the narrow granite-walled wadis, would to a great degree remedy this defect. Perhaps at some future day, when a crowded world thrusts its surplus population into regions now hardly regarded as habitable, Arabia Petræa will bloom like a garden. Granite and limestone furnish valuable soil-ingredients, and the climate is not unfavorable to semi-tropical cultivation.

The flora and fauna of the desert have been often described, yet I imagine that much remains to be studied; the variety, beauty, and fragrance of the shrubs and flowers which the traveler meets in the most forbidding and unexpected spots were to my unprepared mind a remarkable feature. In March I gathered dandelions and daisies at Wadi Useit, also "butter and eggs"; in Wadi Tayyibeh, near saline water, spearmint; and in Wadi Feirân, on the hillsides, sorrel.

The oases with their date-palms, *tarfa* (or tamarisk) yielding manna, *seyâl* (or acacia) yielding gum arabic, *gharkad* shrubs, and thickets of tall reeds, are veritable islands of fertility in an ocean of desolation. At the monastery, cypresses, oranges, peaches, and vines are cultivated, although five thousand feet above the sea-level.

Naturalists enumerate a number of large animals that live in the oases of the desert, among them the gazelle, ibex, jackal, and fox. I met with the head of a gazelle and numerous horns of ibexes, and in Wadi Es-Sleh a Bedouin suddenly appeared with two little half-tamed ibexes about fourteen days old; my traveling companion bought them, but they were unable to withstand the novelty of camel-riding, and, though kindly cared for, died within a few days. Their skins were preserved. I noted on the journey a large field-mouse, a small light-yellow snake two and a half feet long, and a peculiar kind of lizard (?). At Assouan I killed an intensely energetic scorpion, and at many places noted chameleons basking in the sun. Of the numerous and curious fish in the Red Sea, I can only say that some of them proved to be excellent food.

Insects were rarely seen in the desert, and only in the neighborhood of water, or in the oases. I observed red and black ants, one large caterpillar, very few flies, many black beetles leaving behind them well-defined tracks as they crawled over the fine-grained sand, a few moths, a bee, a grasshopper, many spiders, a lady-bug (so called), gnats near the sea-coast, and my traveling companion noted fleas. Mosquitoes, so abundant in Cairo, were not seen nor heard. Twice large birds sailed high above our heads. This is the total of animal life met with in my four weeks' journey, excepting camels, goats, one lamb (which we ate), one donkey (at Tor), a dozen cats (at the monastery), several Bedouins, two Russian ladies, two German philologists, two Irish theologians, three enterprising Americans, and twenty-nine lazy monks.

WHALE-CATCHING AT POINT BARROW.

By JOHN MURDOCH.

ALL through the latter part of the winter the seal-hunters, who are out every day tending their nets, along the shore from Cape Smyth to Point Barrow, have been watching and studying the ice. Running along nearly parallel to the shore and about a thousand yards off, is a bar on which the water is not more than two or three fathoms deep. On this the heavy pack-ice, coming in with the autumn gales, usually grounds, piling itself up into a wall of rugged masses of ice, while inshore the sea freezes over smooth and level. Outside of this is the rough pack, broken masses of ice piled up in irregular heaps like the craggy fragments on a frost-riven mountain-top, but interspersed with undulating fields of ice, many seasons old, and thick enough to resist the pressure when the ice-fields come together before the winds and currents. Occasionally, too, the grounding of heavy masses of ice—there are no true icebergs in this part of the Arctic Ocean—affords sheltered spaces where fields of "new ice" can form undisturbed by the movements of the pack.

Through January, February, and March these ice-fields remain motionless, or are only crushed closer together and pressed harder upon the land by the prevailing westerly gales; but in April the pack gradually begins to loosen, and when the long-wished-for east wind blows, cracks open six or seven miles from the shore, extending often for miles, parallel to the land. These cracks or "leads," as they are called, seldom remain the same for many days, but open and close as the wind changes, now spreading clear of all obstructions for hundreds of yards or even for a mile in width, now filled with loose ice, floating with the current.

It is in these leads of open water that the whales work their way to their unknown breeding grounds in the northeast, passing by Point Barrow chiefly during the months of May and June, and it is during this season of migration that they are hunted by the Eskimos.

The chase of the whale is of great importance to these people. The capture of one of these monsters means meat in abundance; blubber for the lamps, and for trade with the Eskimos whom they meet in the summer; whalebone to purchase ammunition; tools and luxuries from the ships; and the choicest morsel that an Eskimo knows, the "black-skin" or epidermis of the whale. Consequently, the successful whaleman is the best man in the village, and soon grows rich and influential.

But to return to the seal-hunters and their observations of the ice. From long experience, the Eskimos are able to judge pretty accurately where the "leads" will first open in the spring, and, when they have concluded where the boats will be launched, they set to work to select the best path for dragging out the boats through the rough ice-field. They soon make a regular beaten trail, winding in and out among the hummocks, taking advantage of all the smooth fields of ice that they can, and, from time to time as they pass back and forth from their seal-nets, they chip off projecting corners of ice with their ice-picks, and with the same implement widen out the narrow defiles in the road, and smooth off the roughest places. Men sometimes go out on purpose to work for a few hours on the road, using ice-picks or "whale-spades" (something like a heavy, broad chisel, mounted on a long pole, used for cutting the blubber off a whale), which they have obtained from the white men. It is a pretty rough path, however, at the best.

By the middle of April all the hunters have returned from the winter deer-hunt, and the business of getting ready for whaling is taken seriously in hand. The frames of the great skin boats must be taken down from the scaffolds where they have rested all winter, and carefully overhauled and repaired, while every article of wood that will be used in whaling, from the timbers of the boat to the shafts of the spears and harpoons, must be scraped perfectly clean, in honor of the noble quarry. Gear must be looked to, and the skin covers for the boats repaired and soaked in the sea, through holes in the ice cut close to the shore, till they are soft enough to stretch over the framework.

Meanwhile, a careful watch is kept from the village cliff for the dark cloud to seaward which indicates open water; and if the much-talked-of east wind does not speedily begin to blow, the most skillful of the wizards or medicine-men get out on the bluff,

and with magic songs and beating of drums do their best to make it come.

It is not every man in the village who owns an *umiak* that fits it out for whaling, as it requires a good deal of property to procure the necessary outfit. About eight or ten boats from each village make up the usual fleet. The crews—eight or ten men to a boat—are made up during the winter.

The owner of the boat—who is always the captain and steersman—sometimes hires his crew outright, paying them with tobacco or cartridges or other goods, and sometimes allows them a share in the profits, but, I believe, always feeds them while the boat is "in commission." When enough men for a full crew can not be secured, women and even half-grown lads take their places in the boat. One man is selected for harpooner and posted in the bow, and usually another, amidships, has charge of a whaleman's bomb-gun, for firing an explosive lance into the whale, for most of the rich Eskimo whalemen now own these guns.

Now, as to the instruments used for the capture of the whale. Instead of harpooning the whale, or "fastening" to him, as the white whalemen say, and keeping the end of the line fast in the boat, which the whale is made to drag about till the crew can manage to haul up and lance him to death, there is but a short line attached to each harpoon, to the end of which are fastened two floats made of whole seal-skins, inflated, which are thrown overboard as soon as the harpoon is fixed in the whale. Each boat carries four or five harpoons, and several boats crowd round and endeavor to attach these floats to the whale every time he comes to the surface, until he can dive no longer, and lies upon the water ready for the death-stroke. Some of the harpoons are regular whalemen's "irons," but they still also use their own ingenious harpoons, in which the head, made of bone or walrus ivory, with a point of stone or metal set into it, is alone fastened to the line, and is contrived so as to "unship" from the shaft as soon as it is thrust into the whale, and to turn at right angles to the line, like a toggle, under the skin. To kill the whale after he is harpooned, they used in old times long lances, with beautifully flaked flint heads, as broad as one's hand; but now they all have regular steel whale lances, and, as I have said before, most of them own bomb-guns.

Some of the boats are carried out over the ice to the place where they are to be launched before the "lead" opens, and, as soon as open water is reported by the scouts, all start. There is a great deal of ceremony and superstition connected with the whale-fishery. The captain and harpooner of each boat wear special trappings, and streak their faces with black-lead, as, indeed, is often done on festive occasions. Long before the time for whaling, all those

who intend to command whaling boats during the coming season assemble, with all their gear, in the public room and hold a solemn ceremony, with drumming and singing, to insure good luck. Charms and amulets of many kinds are carried in the boats. They believe that the whales are supernaturally sensitive. If the women should sew while the boats are out, or the men hammer on wood, the whales, they say, would leave the region in disgust.

Let us see, now, how the boats are carried out over the path I have described. The boat is firmly lashed on a flat sledge, to which a team of dogs is attached, while the men and women hold on to the sides of the boat, pushing and guiding. Hearing, one day in May, 1882, that one of the Cape Smyth boats was starting for the edge of the ice, two of us set out over the trail, and overtook the party about two miles from the shore, where they were resting, having sent the dogs ahead in charge of two women, with another sledge loaded with all sorts of gear—rifles, spears, and so on. The party consisted of five men and two women. The captain of the boat and the harpooner wore on their heads fillets of the light-colored skin of the mountain sheep, from which dangled on each side a little image of a whale, rudely flaked from rock-crystal or jasper. The captain's head-dress was fringed with the incisor teeth of the mountain sheep, and the harpooner had another stone whale on his breast. One of the women was decorated with a stripe of black-lead diagonally across her face. In the boat, for charms, were two wolves' skulls, the dried skin of a raven, a seal's vertebra, and several bunches of eagle's feathers. They say the skin of the golden eagle—"the great bird"—or a bunch of hairs from the tip of the tail of a red fox, bring great luck. In the boat were also five or six inflated seal-skins, which, when we came up, they were using for seats on the ice.

One of the women soon came back with the dogs, the seal-skin floats were tossed into the boat, the dogs hitched up, and we started ahead, the woman leading the dogs, and the men shoving alongside. When we came up with the first sledge, the dogs were unhitched from the boat and sent ahead with a load of gear for another stage, and so on. On smooth ice the boat travels easily and rapidly; but where it is broken it is hard shoving and rough scrambling for the men, while occasional stops have to be made to chisel out projecting pieces of ice and widen narrow places in the path. Then the dogs get tangled up from time to time, and have to be kicked apart, so that their progress on the whole is slow. When they reach the open water the boat is launched and the gear put on board, and the sledges drawn up out of the way. Everything is put in readiness for chasing the whales, and the boats begin patrolling the open water. The harpoon, with the

floats attached, rests in a crotch of ivory lashed to the bow of the boat, and everybody is on the alert. Sails and oars are never used in the boat when whaling, but the boat is propelled by paddles alone.

Thus they spend the months of May and June, eating and sleeping when they can, for the daylight now lasts through the twenty-four hours, occasionally hauling the boat up to the edge of the ice for a rest. Somebody, however, is always on the watch for whales or seals or ducks, which last now and then at this season pass by in thousands on their way to the north.

When the "leads" close, the boats are hauled up safely on the ice, and all hands come home till an east wind and "water sky" warn them of a fresh chance for whaling.

Let us suppose that there is good open water, and that a couple of boats are hauled up on the edge of the land floe, their crews resting and gossiping, perhaps waiting for the return of the women who have been sent home to the village for food. Suddenly a faint puffing sigh is heard, and a little puff of vapor is seen over toward the edge of the ice. It is a whale "blowing." The men all spring to their feet and quickly run the boats off into the water, and, scrambling on board, grasp their paddles and are off in the direction of the "blow." If they are lucky enough to reach the whale before he escapes, the harpooner, standing up, thrusts the heavy harpoon into him with both hands, and quickly recovers the pole, to be used again. The nearest boat rushes in; other boats, seeing what is going on, come up and join in the attack until the whale is captured. Sometimes, indeed, an opportunity occurs for a successful shot with the bomb-gun as soon as the whale is struck, and the contest is ended at once. But the attack is not always so successful. Sometimes the whale escapes into the loose ice before the boats can reach him; sometimes the harpooner is clumsy, or the harpoon does not hold. Sometimes, too, the whale escapes before enough floats can be attached to him to hamper him, and carries off the harpoons, floats and all. Even if the whale is killed, he sometimes sinks before he can be towed to the edge of the ice, where the "cutting in" is to be done.

When the "lead" of open water is narrow, the natives who own bomb-guns patrol the edge of the ice, watching an opportunity to shoot the whales as they pass. It was when engaged in this kind of hunting that a young acquaintance of ours at Cape Smyth came near losing his life. A man near him, handling his bomb-gun carelessly—the Eskimos are all frightfully reckless with fire-arms—discharged it by accident, sending the bomb into the ice under his feet, where it exploded, shaking him up like a small earthquake.

When the whale is killed, it is towed, as I have said, to the edge of the solid floe, and the work of cutting him up begins. By long-established custom, universal among the Eskimos, the skin, blubber, and flesh of a whale belong to the whole community, no matter who killed it; but, at Point Barrow, the whalebone must be equally divided among all the boats that were in sight when the whale was killed.

They have none of the appliances used by civilized whalemen for easily and rapidly stripping off all the blubber, but hack away at everything in reach, getting off all they can before the carcass sinks. The news soon reaches the villages that a whale has been killed, and there are very few households that do not send a representative to the scene of action as speedily as they can, with sledges and dogs to bring away their share of the spoils. As may be supposed, there is a lively scramble round the carcass. Some on the ice, some crowding the boats, they cluster round the whale like flies round a honey-pot. Leaning over the edge of the boats, careless of the water, they hack and cut and slash with whale-spades and knives, each trying to get the most he can. So far as I have ever heard, this is a perfectly good-natured scramble, and no one ever thinks of stealing from another's pile on the ice. The blubber, meat, "blackskin," and whalebone are soon carried home to the village. The blubber is not tried out, but is packed away in bags made of whole seal-skins, and, with the meat, is stowed away in little underground chambers, of which there are many in the villages.

The "blackskin" is eaten fresh, and is seldom if ever cooked. This curious dainty is the epidermis or cuticle of the whale. It is about an inch thick, and looks, for all the world, like black India rubber; it is not so tough, however. Civilized whalemen are nearly as fond of it as the Eskimos, but are not in the habit of eating it raw. When nicely fried in the fresh, sweet oil of the "try-pots," when they are "boiling out" the blubber of a whale, for instance, it is very palatable, tasting much like fried pigs' feet. It is also good boiled and "soused" with vinegar and spices. The Eskimos are fond, too, of the tough white gum round the roots of the whalebone.

The jawbones of the whale are cut out and preserved. From these and from the ribs are sawed out strips of bone for shoeing the runners of the sledges. In fact, everything that can be cut off from the whale, before the carcass sinks or is carried off by the current, serves some useful purpose.

The most favorable time for whaling is when there is a continuous "lead" of open water, not more than a couple of hundred yards wide, with a solid pack of ice beyond it. Then the whales must pass up within sight or hearing of the boats. When the

open water is very wide, the whales may pass at a distance unnoticed, or so far off that it is impossible for a boat to overtake them.

If there is much loose ice, the crafty animals take advantage of it, and come up to breathe at little holes among the floes where a boat can not reach them.

As the season advances, the whales grow scarcer, and the whalemen relax their vigilance and pay more attention to the capture of seals, which they shoot through the head when they rise near the boat, securing them with light harpoons before they have time to sink. At this season, also, the whale-boats some times capture walrus and white whales.

At length several days pass without a whale being seen, and one by one the crews give up looking for them and bring home their boats, until by the first of July the whaling is over for the year, the boats are all in, and everybody is preparing to leave the village for the summer excursions.

SKETCH OF DANIEL GARRISON BRINTON.

By Dr. CHARLES C. ABBOTT.

A FEW years prior to the widely spread interest in American archæology that is now taken, there was published in Philadelphia a small duodecimo volume of two hundred pages entitled Notes on the Floridian Peninsula, concerning which its author states in his preface, "The present little work is the partial result of odd hours spent in the study of the history . . . of the peninsula of Florida." A "little" book, in one sense, it is true, but far from it in all others, and it remains to-day our best *résumé* of the archæology of that wonderful peninsula. The author of this volume, but twenty-two years old at the time of its appearance, is the subject of the present sketch—DANIEL GARRISON BRINTON.

Dr. Brinton was born May 13, 1837, at Thornbury, Chester County, Pa., and is of English descent on both the paternal and maternal side. His ancestor, William Brinton, came from Shropshire, where the family had lived for many generations. He became an early member of the Society of Friends, and emigrated to the colony of Pennsylvania in 1684. His descendants have generally continued their attachment to Quakerism.

The life-long interest which he has taken in the study of the American Indians may have been owing to the fact that on his father's farm was a "village site" of some ancient encampment of the Delaware Indians. Many a day of his boyhood was passed in collecting from this and similar localities the broken arrow-

points, the stone axes, and the fragments of pottery which marked the presence of this older and mysterious race. The study of McClintock's Antiquarian Researches, a now almost forgotten volume, fixed and expanded this taste. The work, however, to which he attributes beyond all others a formative influence on his youthful tastes was Humboldt's Cosmos, the English translation of which by Colonel Sabine was his favorite reading at the age of fifteen and sixteen. The poetic hues in which this great master knew how to garb the dry facts of science, and the wonderful skill with which he developed the intimate relationship of lower and inorganic existence to the thoughts, aspirations, and destiny of man, stimulate the imagination with the force of a great epic.

Dr. Brinton graduated at Yale College in 1858, and studied medicine in the Jefferson Medical College, Philadelphia, where he took the degree of M. D. in 1860. After a year, spent chiefly at Paris and Heidelberg, he was recalled by the events of the war and entered the army as Surgeon of United States Volunteers. After serving in the field as Medical Director of the Eleventh Army Corps, he was sent to Quincy and Springfield, Ill., as superintendent of hospitals, where he remained until the close of the war. In 1867 he was tendered the position of editor of the Medical and Surgical Reporter, at that time the only weekly medical journal in Philadelphia. This position he held uninterruptedly until 1887.

In 1884 he was appointed Professor of Ethnology at the Academy of Natural Sciences, Philadelphia, and in 1886 Professor of American Linguistics and Archæology in the University of Pennsylvania. At both the institutions named he delivers a course of lectures every winter, which are highly appreciated by the public, as the numbers attending them attest. His subject-matter, being both ethnologic and archæologic, necessarily covers an enormous field; but Brinton very successfully exercises the faculty of conciseness, yet never at the expense of lucidity.

Dr. Brinton's contributions to scientific literature began, as already stated, in 1859, when he published The Floridian Peninsula, its Literary History, Indian Tribes, and Antiquities, the result of some months' travel in that State. His next work of importance was The Myths of the New World: a Treatise on the Symbolism and Mythology of the Red Race of America (New York, 1868; second edition, 1876). Other volumes which have appeared from his pen are The Religious Sentiment, its Source and Aim: a Contribution to the Science of Religion (New York, 1876); American Hero Myths: a Study in the Native Religions of the Western Continent (Philadelphia, 1882); Essays of an Americanist (Philadelphia, 1890); Races and Peoples; Lectures

on the Science of Ethnography (New York, 1890); and has now in press a work entitled The American Race; a Linguistic Classification and Ethnographic Description of the Native Tribes of North and South America. It is the first attempt ever made to classify all the Indian tribes by their languages, and it also treats of their customs, religions, physical traits, arts, antiquities, and traditions. The work comprises the results of several years of study in this special field.

Of the ethnological papers by Dr. Brinton the National Legend of the Chahta-Muskokee Tribes, Notes on the Codex Troano, The Lineal Measures of the Semi-civilized Nations of Mexico and Central America, On the Xinca Indians of Guatemala, and The Books of Chilan Balam, are specially prominent, as are the strictly archæological papers, such as The Probable Nationality of the Mound-builders, in which the author favors the theory that the mound-builders of the Ohio Valley were of the same race as the Choctaws, and probably their ancestors; On the Cuspidiform Petroglyphs, or Bird-track Sculpture of Ohio; and the later Review of the Data for the Prehistoric Chronology of America. Dr. Brinton has given attention, too, to folk-lore, as a subject worthy of scientific treatment, and published The Journey of the Soul, a comparative study of Aztec, Aryan, and Egyptian mythology, and also The Folk Lore of Yucatan.

This goodly list, of which any scientific worker might well be proud, if the results of a long life, by no means covers the ground of Brinton's scientific and literary activity. He has been both publisher and editor of the Library of Aboriginal American Literature, of which eight volumes have appeared, six of which are edited by Brinton. The titles, given in order of their publication, are: The Chronicles of the Mayas, The Comedy-Ballet of Güegüence, The Lenâpé and their Legends, The Annals of the Cakchiquels, Ancient Nahuatl Poetry, and The Rig Veda Americanus. These works are all of unquestionable merit, notwithstanding they have been subjected to considerable adverse criticism. This is not to be wondered at, as works of this character, if edited in a pronounced manner, by one having strong opinions that are plainly expressed, are sure to meet with some opposition, which reflects, however, nothing upon the skill with which they are edited, and is, we hold, a pretty certain indication of their value as contributions to knowledge. Were further testimony to this wanting, it is shown in the fact that this series obtained for its author the prize medal of the Société Américaine de France; this being the only instance in which it has been decreed to an American writer.

In linguistics Dr. Brinton has published during the past two decades, Grammar of the Choctaw Language, by Rev. Cyrus

Byington, edited by Brinton; Contributions to a Grammar of the Muskogee Language; The Ancient Phonetic Alphabet of Yucatan, describing Lauda's so-called Maya alphabet; The Arawack Language of Guiana, in which the author shows that the nations of the Bahamas and Antilles at the discovery were of the Arawack stock; this essay contains an analysis of the primitive language of Hayti On the Language of the Natchez, wherein the writer identifies the language of the Natchez as largely a dialect of the Chahta-Muskokee family; the Names of the Gods, an exegetical study of the *Popol Vuh*, or national book of the Quiches of Guatemala; A Grammar of the Cakchiquel Language of Guatemala; American Languages and why we should study them; The Philosophic Grammar of American Languages, as set forth by Wilhelm von Humboldt, with the translation of an unpublished memoir by him, on the American verb; On Polysynthesis and Incorporation; Notes on the Manque, an extinct dialect formerly spoken in Nicaragua; The Taensa Grammar and Dictionary, in which are shown the fraudulent claims of the alleged Taensa language, introduced by Parisot; The Study of the Nahuatl Language; The Phonetic Elements in the Graphic System of the Mayas and Mexicans; The Conception of Love in some American Languages; On the Ikonomatic Method of Phonetic Writing; and, in 1889, associated with Rev. Albert Seqaqkind Anthony was issued a Lenâpé-English Dictionary, based upon a manuscript of the last century, preserved in the Moravian church at Bethlehem, Pa.

In general linguistics he has contributed several papers to the Proceedings of the American Philosophical Society on the possibility of an international scientific tongue, the chief arguments in which were summed up in a pamphlet published in 1889 on the Aims and Traits of a World-Language.

In the great conflict between scientific thought and religious dogma, Dr. Brinton has always occupied a pronounced position. His volume on the Religious Sentiment begins by an absolute rejection of the supernatural as such, and explains all expressions of religious feeling as the results of familiar physical and mental laws. These opinions he further emphasized in an address on Giordano Bruno, published in 1890, a philosopher to whose theories he had paid considerable attention in early life.

While singularly devoid of taste or faculty for music—which may perhaps be attributed to six generations of Quaker ancestry—Dr. Brinton has always cherished an ardent love of poetry. He is Vice-President of and a frequent contributor to the Browning Society of Philadelphia, which numbers nearly seven hundred members; he is also a friend and disciple of Walt Whitman, and has published an essay explaining his eccentric versifications.

In November, 1889, the Archæological Association of the University of Pennsylvania was organized, and Dr. Brinton at once became a leading spirit in its councils, and by personal labor and influence materially advanced its progress. The formation of a museum is necessarily slow work, and too often fails through misdirected energy; but this has not been the fate of the undertaking in question. Looking upon such a museum as valuable in proportion to its collections being the result of exploration intelligently conducted, Brinton insisted, from the very outset, that by such means, rather than by the purchase of collections or single specimens, should the work be carried on. His wise counsel has prevailed, and as material for the illustration of archæological lectures, the university now possesses hundreds of objects of which every available fact with reference to their history is known.

Dr. Brinton's scientific work covers so broad a field that it is difficult for any one person to follow him wheresoever he leads; but if it be a safe guide to accept the general trend of criticism among archæologists, ethnologists, and those learned in linguistic lore, he has touched upon no subject without throwing light thereon, and to-day, still young in years and vigorous both of mind and body, is preparing for further labors. American science and American letters may be proud of such a worker, for his position, both as a scientist and a *littérateur*, is no uncertain one.

Besides the two positions that he holds in Philadelphia, to which reference has been made, Dr. Brinton is President of the American Folk-lore Society and of the Numismatic and Antiquarian Society of Philadelphia; member of the Anthropological Societies of Berlin, and Vienna, and of the Ethnographical Societies of Paris and Florence; of the Royal Society of Antiquaries, Copenhagen; the Royal Academy of History of Madrid; the American Philosophical Society, the American Antiquarian Society, etc.

The aboriginal race of Tasmania, of which only a single survivor remains—if she be really of pure blood, which is doubted—was one of peculiar interest, for it continued down to our own times at a degree of culture hardly equal to that of the palæolithic flint-workers. The making of rude stone implements and of baskets were almost the only arts they possessed. They made fire by the stick and drill; for ornaments they had strings of shell; and for weapons only the spear and the *waddy*. Their huts were slight, and they had no knowledge of agriculture. Dr. Tylor says that their life may give some idea of the conditions of the earliest prehistoric tribes of the Old World, except that they had a milder climate than the others and no large animals, and were in some arts rather below them. All the information respecting these people has been collected by Mr. H. Ling Roth for his book upon them.

EDITOR'S TABLE.

KOCH'S CONSUMPTION-CURE.

THE very great importance of the subject of the cure of consumption, the enormous extent of the malady and its great fatality, would naturally be the means of attracting universal attention to any remedy which was supposed to possess curative powers over it. To one who is familiar with the writings of Koch on this subject it need not be said that he is not properly to be held responsible for the exaggerated ideas which have been received of the efficacy of the new agent; nor, indeed, are any of the numerous scientific men who have carefully observed its effects in different countries. But many visionary persons in the medical profession, and many not in it, became imbued early with the impression that there had at last been found a means of working miracles. Moreover, a few designing and unscrupulous doctors intentionally aided, to a slight extent, in the propagation of this idea; but probably the most generally operative cause of the exaggerated notions that have obtained with regard to the potency of the new remedy lies in the popular inclination toward a belief in the supernatural. People who wish to be deceived often begin by unintentionally endeavoring to deceive themselves.

That the public should derive an idea of the potency for good of this remedy far beyond what Koch has ever claimed for it, or what any experience with it would warrant, is not surprising—such has often been the case before with new and relatively untried remedies. Not only the public, but the doctors, are often deceived by the heralding of new cures. It is but a few years since the benzoate of soda was published by reputable physicians in high places in Austria as a means of curing consumption. Medical literature teemed with accounts of its powers for a few months, and then it sank rapidly into oblivion. A few years later there came to us from the Riviera most startling accounts of cures of consumption and various other pulmonary diseases by means of the introduction into the blood of sulphureted hydrogen dissolved in carbonic acid. These accounts were most circumstantial, and the truth of them was vouched for by several men of good standing in the medical profession. So brilliant were the results claimed that the method of treatment soon became common. Many doctors tried it in many cities, and after a fluctuating existence of a few months the Bergeon treatment, as it was called, quietly died and was decently interred among many other therapeutic procedures that had once had their day. Some years ago the world was startled by the assertion that in South America a cure for cancer had been found in the bark of a climbing plant called *condurango*. The sensation created by this announcement is remembered by many doctors who are still young. It was tried in that year here and in various European capitals, and was discarded as inert and useless. Condurango was then supposed to be dead as a therapeutic agent beyond all possibility of revival, when suddenly the serenity of the medical world was again rudely shocked by a publication which emanated from the Professor of Medicine in the University of Heidelberg, two years later, in which he reported the cure of a cancer of the stomach by the use of this drug. Since then evidence has accumulated to show that condurango does seem to possess a curative power in some forms of cancer of the stomach; but it is known to be inert as regards cancer elsewhere. It would be easy to adduce evidence in favor of the importance of receiving encomiums upon new and marvelous cures with the utmost caution.

It can not yet be said that the exact status of Koch's remedy is fixed; nor can we even yet say with certainty that this much-heralded cure is destined to survive among established methods at all. The most that is claimed for it by its most ardent advocates is that it seems capable of depriving the bacillus of the material in which it thrives best—i. e., of disintegrating and destroying tuberculous tissue. There has been no claim that it has any direct effect upon the existence of the bacillus, nor that it, having deprived the bacillus of its food, tends in any way to remove that parasite from the body, and thus to eliminate the possible source of danger of subsequent or more general infection. Under its influence in some forms of local tuberculosis — especially of the skin — it has been shown that tissue which was of the very lowly organized variety characteristic of the disease has been at first in part and then wholly replaced by a tissue of higher organization, and one that is likely to be permanent.

In regard to tuberculosis of the lungs, there can be no question that improvement in the patient's general condition and also evidence of improvement at the site of the disease have followed the use of this remedy. The general improvement manifests itself by a gain in weight, lessening of fever, increased appetite, better sleep. The local improvement is surmised from certain changes to be observed by auscultation and percussion, together with a diminution in the severity of the cough and in the amount of the expectoration, and also a diminution in the number of the bacilli in the expectoration or their complete disappearance from it. This has not always been the case. In not a few instances no improvement has resulted, and in other cases direct and most damaging results, including hæmorrhage and even death, have been brought about by it. In the treatment of tuberculosis of the bones and joints results seem to have been widely different. It is certain that some cases have been benefited, and equally certain that others have not.

Quite startling testimony to the possible causation of bad effects in a miscellaneous group of cases has recently been adduced in Berlin. This testimony is in the shape of the results of twenty-one autopsies made by Prof. Virchow of the bodies of patients who had been treated by Koch's fluid. Of these twenty-one cases sixteen were cases of consumption in the ordinary sense—that is, cases in which the disease was either wholly or chiefly in the lungs. The others included bone disease, chronic pleurisy, and tubercular meningitis. Some of the diseased changes described in important tissues and organs—in the lungs, heart, brain, intestines, and elsewhere, which can be directly ascribed to the influence of the "lymph"—make one feel that the remedy is quite as potent for evil as it is for good. Some of these effects were very disastrous in their results, even though the cases had, as a rule, been carefully selected by competent physicians as being appropriate subjects for the new treatment. Virchow shows how the process of consumption in the lungs can be made to spread and involve greater areas by the gradual loosening of masses of tubercular tissue from their original sites and their transference elsewhere. He shows how the disease in the larynx can be caused to take a sudden and very serious turn in consequence of the local swelling produced by the treatment. This may be so great as to prevent the entrance of air to the lungs, and cause death at once by suffocation. He shows how a fresh eruption of tubercles may be caused by it, and demonstrates their presence in the coverings of the brain and of the heart and elsewhere. He explains these occurrences by the hypothesis that the new remedy is capable of disturbing a localized tubercular focus and setting free the virus of the disease

under such circumstances that it is capable of disseminating tubercle in other parts. He also shows that it is capable of causing intense congestion and hæmorrhage. Virchow is not the only critic of Koch's method, though he is the most prominent one. Others in Berlin and elsewhere have related cases in which the disease extended while the patients were under treatment.

No one who has tried it carefully at all questions its powers; but the most competent observers agree that its general or indiscriminate employment would be most unsafe. Furthermore, competent observers here have concluded that, even though the cases be selected ever so carefully, if the dose of the fluid be not most accurately adjusted to the condition of each individual case, serious general disturbances may be caused and local changes at the site of the diseased tissue may be so marked as to produce dangerous results. These results are among those described by Virchow as due to the sudden dislodgment of tubercular masses in the lungs of such large size that they can not be coughed up, and their falling into more dependent places in the lungs and becoming lodged there and giving rise to new infection which may develop rapidly.

On the whole, it seems fair to say that before conclusive results can be obtained in the treatment of so chronic a disease as consumption time must elapse —time measured by months or years— before the present method can be said to have been thoroughly tried and assigned to its definite place in the therapeutic armamentarium. It may be a boon to mankind in comparison with which vaccination is a trifle; and it may yet be relegated to the dimly lighted region where rest many once promising methods whose day is long since forgotten. Meanwhile the treatment of consumption is by no means hopeless without Koch's fluid. Exactly the kind of cases that are doubtless often capable of being benefited by it have long since been known to be greatly improved and often cured by hygienic and dietetic treatment. It is within the experience of the writer that several such cases have been permanently cured at the Saranac sanitarium in the Adirondacks when they seemed to be gravely ill and after they had developed some of the symptoms which are usually regarded as most alarming. Many other equally good resorts are to be found in elevated regions in different parts of the country. Many cases that are not permanently cured in these mountainous regions are greatly improved, so that life may be indefinitely prolonged if one is willing to make his home considerably above sea level. It is a matter of common experience to every pathologist to find in the bodies of people who die from widely different causes, often in those who die from surgical injuries or accidents, perfectly unmistakable evidence of consumption. Old tubercular deposits in the upper parts of the lungs are exceedingly common in people who ceased to cough or present other symptoms of the disease years before they died. In many of these cases no especial care could have been taken, certainly no systematic and intelligent treatment could have been followed, for these patients die in hospitals after long lives of toil, privation, hardship, or excesses. Thus not only is the disease often curable by care, as we have said, but it often gets well wholly without care and even without proper food and shelter. In the absence of positive proofs of the general efficacy and safety of the new treatment, and in view of the fact that it is still accessible to but very few of our consumptives, those who are threatened with consumption or who are actually suffering from it should not allow their hopes of relief by the new cure to take the place of those hygienic measures which, if rightly applied, may serve to ward off many of the most serious symptoms of consumption, and sometimes even to cure the disease.

INTELLECTUAL LIBERTY.

THE recent prosecution of the Rev. Howard MacQueary for heresy has brought out in a striking manner the fact that the sympathies of the public in a case of this kind are, as a rule, strongly with the defendant—with the man who is striving to obtain recognition for intellectual rights as against arbitrarily imposed dogmas. We do not say that the prosecutors in such a case are to be blamed. Their motives may be, and doubtless in general are, of the purest, and their logical position may be very strong. Still, they labor under the disadvantage of administering and striving to enforce a system in which authority takes the place which, in other fields of thought, is only assigned to proved and still provable results of investigation. Long ago men were led to think and believe so and so: no otherwise must they think and believe today. Such is the principle that governs adhesion to theological standards—a principle that has had its uses in past times by giving stability to institutions under which the forces of society were being organized and the sympathies of men developed. Manifestly, however, this principle is becoming more and more out of harmony with the spirit of the age. Men now know that, apart from constant—not reassertion, but—reverification, the opinions of their ancestors are not to be depended on for guidance; and they do not see why this should not apply as much in the theological region as in any other. The creeds *may be all true*, and it is certainly no part of our business to say they are not; only in these days it is almost impossible for intelligent men not to hold them subject to such verification as their nature and alleged evidences admit of. Subjective impressions, we all know, are just as liable to error as objective ones; and because a man, many centuries ago, held that he had received a supernatural communication we can not feel absolutely certain—unless collateral proofs of considerable cogency are forthcoming—that he really received such a communication and was not under the influence of illusion. In saying this, our object is not in any way to weaken the hold which theological doctrines may have upon any mind, but merely to explain how it is that so much public sympathy seems to be accorded to those who seek to escape from what, to them, has become the bondage of authority. In our institutions of secular learning the putting forward of a new theory or the discarding of an old one, far from subjecting a man to forfeiture of office, gives a certain additional interest to what he has to say, and he is allowed the freest possible scope for developing his thought and his conclusions. Of course, he must run the gantlet of criticism; but this is just what a man who thinks he has discovered new truth desires. We do not blame our ecclesiastical friends for not acting at once on similar principles, for we know they can not do so, and we are very ready to believe that many of them at least, if not most of them, are doing the best they can in their several positions, and acting fully up to their lights. But none the less do we maintain that verification is the only charter on which beliefs of any kind can be properly or safely held, and that this truth must eventually be recognized in every field of thought and speculation.

LITERARY NOTICES.

SOCIALISM, NEW AND OLD. By WILLIAM GRAHAM, M. A., Professor of Jurisprudence and Political Economy, Queen's College, Belfast. International Scientific Series. Vol. LXVIII. New York: D. Appleton & Co. Pp. lv+416. Price, $1.75.

THE latest addition to the International Scientific Series is a very timely one. The subject of socialism or social reconstruction is in the air; and a competent thinker, who has any well-matured views on the question, is sure of an attentive hearing. Prof. Graham, in the work before us, deals with the

subject of socialism, first historically, then critically, and lastly constructively. From first to last he holds the attention of the reader by the vigor of his style and his own manifest interest in the important questions at issue. The thorough impartiality of his attitude also compels admiration. The object he has set before himself is to discover in what points the present constitution of society is faulty, and what promise of better things the different socialist programmes now before the world contain. Considering that he is an exponent of what is so often spoken of as "the dismal science," the energy with which he arraigns the vices of the existing social order and the sympathy he expresses for the unhappy victims of an excessive competition may appear surprising; but the fact is, that political economy to-day is not content with recording facts and indicating the laws of which these facts seem to be the expression and proof, but aims at showing what ought to be as well as what is. It no longer confines itself to the question, How is the maximum of wealth to be produced? or, What motives sway men in the pursuit of wealth? It inquires into the general conditions of social well-being; it wants to know how far it may be possible to check that reign of universal cupidity on which the older economists seemed to count as an unalterable attitude of the human mind; and it asks searching questions as to the nature and requirements of justice between man and man. The one thing to dread in connection with this new departure of political economy is a possible lapsing into sentimentalism The wider the scope it allows itself the more rigorously should it adhere to strict scientific method. There is nothing weakly sentimental in the tone of Mr. Graham's book, and yet it hardly appears to us that he has given due recognition to some of the severer aspects of the problem with which he is grappling. "Man's inhumanity to man," as we all know, has been a dark feature in past history; but is it not the case that Nature itself, in the production of imperfect individuals—imperfect from the social point of view, and taking into account the present development of civilization—is primarily responsible for a large, if not the larger, part of the troubles with which we are contending to-day? Every one in the least familiar with the doctrine of natural selection knows that if different species are kept up to a certain standard of efficiency, it is due to the disappearance in the struggle for life of the more poorly endowed individuals that come into existence. Among mankind, if even the *most* poorly endowed perishes from want, our whole civilization is considered to be disgraced. This is a point which certainly requires very careful consideration, not only in connection with the criticism of existing institutions, but also in connection with any plans which may be formed for the improvement of our social organization. There is no use in trying to fight against Nature; the only thing to do, when we clearly recognize the incidence of a natural law, is to see how we can best convert it to our uses or turn aside any injury it may threaten to our interests. Thus, having recognized the fact that, by the operation of the simple law of variation, Nature will produce imperfect individuals, ill-adapted to their environment and destined in all probability to be a drag on the society in which they have a place, the question arises how to deal with them; and that question ought to be very fairly and fully met.

But, supposing even that all individuals produced were of average quality, how does the law of population bear upon the social question? How far are our social troubles the result of an undue rate of increase in population? It is true that there are large tracts of the earth yet unoccupied, but the *vis inertiæ* of mankind counts for something; and it does not follow because there is still room for settlement that any given rate of increase might not be in excess of the available means for spreading population over the face of the earth. In early ages tribes used to swarm very much like bees; but in those days men were not particular where they found their new abodes, or whom they dispossessed, or otherwise disposed of, in doing so.

Looked at from certain points of view, competition seems a terrible thing; but is there any certainty that the world could do without it? The successful and the less successful or unsuccessful alike are impelled by it to exertion; it keeps the world at work, and so far helps to make the world happy. What would come from any marked

relaxation of the law that forces us all to keep our faculties in exercise it would be difficult to say; but, taking into account what we know of average human nature, we can hardly predict that the effect would be good. It is easy to find fault with Nature, but not so easy to put her aside and do the work that she is doing. There are few intelligent men who do not recognize what an advantage it is to them to be, in many things, under the law of necessity; and probably also there are few who have much reason to pride themselves on what they have done wholly apart from any such pressure. When a man may either do a thing requiring effort or leave it undone, the chances that he will do it are not overwhelmingly great.

Mr. Graham criticises very effectively the wilder suggestions of socialistic writers, but he does not hesitate to express his opinion that a certain infusion into legislation and government of the socialistic spirit and of socialistic methods is a present necessity. "The state," he says, "has great power: through its laws and institutions it can affect the relations of classes. It can temper great inequality. It can mitigate poverty. It can check the strong oppressor. It can protect the poor, their health, their lives, their property. Many of these things it has already done to some extent, and it has shown an increasing tendency, within the past forty years, to interfere in order to protect the feeble workers and to restrain unscrupulous employers. . . . Its duty is more than the protection of life and property. It has to make just and beneficial laws respecting property. It is its duty to enforce contracts; but it may also be its duty to narrow the sphere of contracts in certain cases where the contracts can not really be free." He draws a fearful picture of what would have happened in England had it not been for the interference of the state in the passing of factory laws and other similar acts. "We should have had a proletariat of servile workers, degraded in physique, in mind, in morals; mothers working in mines and factories, their sickly children dying without a mother's care, or surviving with enfeebled frames; other children ignorant and lawless, worked to death or growing up savages; the whole laboring population turned into mere human plant and instruments to make the fortunes of masters, constantly becoming more insolent and inhuman from impunity. We should have had the slave gangs of the Roman Republic repeated, only that the slaves would have been the countrymen of their masters, neither conquered in battle nor born in slavery." This is strong language, and to some the conclusion may appear somewhat too dogmatically stated. Some such idea, we think, must have occurred to the writer himself, for he hastens to add, "That is a deducible consequence, had the system continued in its strictness and the hands submitted." It is worth recalling that so judicious and philanthropic a man as the late John Bright was of opinion that the factory laws had done more harm than good. Prof. Graham's book is one that ought to be widely read, as we are persuaded that, whether the writer's own conclusions are accepted or not, his candid and able discussion of the various questions comprised under the general head of "Socialism" can not fail to be helpful and beneficial.

THE DRAPER CATALOGUE OF STELLAR SPECTRA. Photographed with the Eight-inch Bache Telescope as a Part of the Henry Draper Memorial. Astronomical Observatory of Harvard College, EDWARD C. PICKERING, Director. Pp. 388.

THIS volume contains a catalogue of the photographic spectra of 10,351 stars, nearly all of them north of 25° south declination. Six hundred and thirty-three photographic plates are discussed and 28,266 spectra measured. Exposures of about five minutes were generally used for equatorial stars, and somewhat longer exposures for northern stars. Photographic plates eight inches by ten were employed; and at each exposure the spectra were obtained of all the stars of sufficient brightness in a region of 10° square. All stars brighter than the seventh magnitude would generally give images of sufficient intensity to be measured, unless they were of a reddish color. Many stars of the eighth magnitude or fainter appeared on the plates with sufficient distinctness to be included. The total number of spectra on a single plate sometimes exceeded two hundred. The plan of work was such that the entire sky north of 25° S. was covered

twice in the first cycle of photographs. The plates overlapped, so that a spectrum which appeared near the corner of one plate would appear near the center of another. The work was then repeated by a second similar cycle of plates. Each star should, in general, appear on four plates. Owing to the overlapping of the regions and the repetition of plates which were not satisfactory, this number is greatly increased for many of the stars. The faintest stars appear on only one plate. In this case a second independent measure was always made. Eight type photographs of as many stars are given in the frontispiece to the volume. But the general appearance of a copy of a photograph varies so much with changes in exposure and development that it is difficult to convey an idea of the original negative by a paper print.

GUIDES FOR SCIENCE TEACHING. No. VIII, INSECTA. By ALPHEUS HYATT and J. M. ARMS. Boston: D. C. Heath & Co., Publishers. 1890.

THE teachers are again under obligations to Prof. Hyatt and also to his coadjutor Miss Arms for the admirable Guide which is now before us. One follows a path laid out by this distinguished naturalist sure that he will have no pitfall in the way. He does not start on a road that is just six weeks long, but finds a broad avenue, with here and there places where he can use his own powers of observation and perhaps find a shorter cut. As stated in the preface, the Guide is a series of replies to questions which have arisen in the minds of its authors while teaching. "Teacher and scholars should recognize that science is infinite, and demands from all its votaries a modest acknowledgment of this fact. They should work more as companions learning from each other's observations, and less as teacher and pupils, than in those studies which can be taught from written treatises." The Guide is illustrated by 223 figures, derived from the highest sources or drawn from originals, and presents the latest knowledge concerning the structure and classification of insects. To an old-time entomologist it will seem odd to find other groups raised to the dignity of the seven well-known orders, for now we have to face sixteen orders. This, after all, simplifies the work of analysis. A unique diagrammatical plate, showing the probable origin of the different orders and their relation to each other; a synopsis of the contents; a list of letters and signs which are uniform throughout the book; and an exhaustive index at the end combine to make the work an indispensable guide to the study of insects.

HIGHER EDUCATION OF WOMEN IN EUROPE. By HELENE LANGE, of Berlin. Translated and accompanied by Comparative Statistics by L. R. KLEMM, Ph. D. International Education Series. Edited by W. T. HARRIS, LL. D. New York: D. Appleton & Co. Pp. 36+186. Price, $1.

IN this work, those interested in the higher education of women (and who out of Germany are not?) will find a most rational treatment of the subject.

In the editor's preface attention is called to the changed condition of women by the advent of labor-saving machinery, which has taken the old hand-labor from thousands. Multitudes who were formerly occupied are stranded for want of something to do. The incompetent become paupers. This condition presses harder upon the women, and avenues of rough industry which are closed against them drive them to immoral lives. It is believed, and with good reason, that, if every avenue of work was opened equally to women, different results would follow.

The figures given by Dr. Klemm show that the question of the higher education of women is no longer a problem in this country, and England is fast following our example. In other European countries, notably in Prussia, the case is far different, and in the one occupation for which women are eminently fitted, that of teachers, not more than ten per cent are found in this field, as compared with the United States, where sixty-three per cent of the entire number of teachers are women; taking the cities of the United States alone, over ninety per cent are women. Now, either one of two things is to be noted from these figures—either we are committing a colossal blunder or the Germans are.

Miss Lange says: "The English teacher and principal enjoys unquestioned authority, externally and internally. In German public girls' schools the older students know, or instinctively feel, that the education of the

female teacher, obtained in a normal school, is despised by the male teachers who obtained theirs in the university. It is too obvious that the women are found only in subordinate positions (exceptions not counted) of the school organism. No wonder that the pupils sometimes refuse them the respect which is offered as a matter of course in England, where the female teachers are provided with the highest professional education." Quoting again, she says: "In France there were no preparatory schools for the university. Only after the downfall of the second empire, after the humiliating experiences in 1870–'71, steps were taken favorable to women. The Government became convinced of the fact that an elevation of the whole people is only possible by means of an elevation of its women. The motion of Camille Sée to found and maintain lyceums for women was adopted without delay. 'Our law is a moral as well as a social and political law'—thus he pleaded for it, in 1880, before the Chamber of Deputies—'it concerns the future and security of France, for upon the women depends the greatness or decay of the nations.'"

In Portugal "the question of establishing special girls' lyceums is being agitated; a violent controversy has been going on concerning this, and the desire of many Portuguese is that 'their ladies may remain in future as charmingly amiable and foolish children as they have been since Adam's time.'" "Clemens Nohl speaks in his Pedagogy for Higher Schools of the absolute necessity to grant the female sex a thorough education, and says the mother needs it for the sake of her family, the unmarried woman for her own sake."

One forcible argument which is not urged by Miss Lange comes to one when he realizes how much work is done by women in the post-office, telegraph, and other public departments in England, or, if he chances to pass the Treasury and other departments in Washington at the noon hour, and sees the thronging thousands of women pour out from these buildings, he feels that, in case of war, hardly a man would be needed at home to carry on the minute details of office work. The Landwehr and the Landsturm could march out to a man, and not a wheel of government machinery would be checked in its movement. Germany, in this respect, is still in the Oriental stage, and it behooves her public men to look into this matter from the standpoint of military strength. Certainly such an argument might reach her, despite the uniform brutality which marks a German's attitude toward women as contrasted with their treatment by other nations.

A WASHINGTON BIBLE-CLASS. By GAIL HAMILTON. New York: D. Appleton & Co. Pp. 303. Price, $1.50.

THE story of the Bible-class is told in an introductory chapter. A mother in Washington, embarrassed by the refusal of her sons to accept certain doctrines as they are held by the theologians, and finding it equally embarrassing to teach them what her reason could not approve, consulted with other mothers about the religious instruction of their children. The end of the consultation was the formation of a class to study the Bible, not with reference to speculation, but to find the truth in it; not what there might be of Calvinism, or Lutheranism, or agnosticism, or Catholicism, or Universalism, but what is Scripture; not what men say Scripture says and means, but what Scripture itself means and says. "The class, as it grew, embraced members of the families of the Cabinet, of Congressmen, diplomats, scientific and literary men, etc., and persons of a great variety of shades of belief. The class was at first intended to be conversational, and its idea one of common study, comparison of results, and general conference"; but the woman who was chosen leader soon found herself doing most of the talking, and the proceedings, as they are presented in the book, took the form of lectures. The tenor of these lectures is what we might describe, without presuming to express an opinion or to approve or disapprove, as embodying a common-sense view of the questions that arose. The narrative is composed, as to its most remarkable passages, in an anthropomorphic state of mind, which sees God in everything, regards all phenomena as his direct act, and personifies him as the actor. It is assumed that the destruction of Sodom and Gomorrah was by an eruption of natural gas in that asphaltic region; that Lot was warned by a messenger who

foresaw the eruption, and his wife lingered and was caught in a shower of saltpeter and sulphur. A parallel to the sun standing still in Joshua may be found in the red sunsets of 1883 and 1831, and other phenomena recorded in history. If the literal accuracy of the accounts is not established by this kind of reasoning, neither science nor piety need lash itself to fury over the explanations of literature. They are questions of literature. They are not questions of faith. It is science itself which forbids us to pronounce too confidently against even the literal truthfulness of the Bible. Many things which might be given up to legend without impairing the moral value of the Holy Scriptures, because God can be illustrated by a legend or a myth as well as by a fact, science and research seem to be basing upon a true historical foundation. "The rationalist must be wary with his myths, for the Egyptian explorers are at his heels." The natural possibility of the passage of the Red Sea is illustrated by citing the bar at Mount Desert, over which a retreating army might pass at low tide over to Bar Island, while the returning high tide should keep the pursuing army on Mount Desert; only it was the wind that played the part of the ebb tide at the Red Sea. In like spirit with these explanations the leader of the Washington Bible-class discoursed of the story of the Garden of Eden, of the Mystery of Melchisedek, of the Call of Abraham, of the Institutes of Moses, the Origin of Sacrifice, the attitude of Christ and the Apostles toward the Mosaic Institutes, Inspiration, the Atonement, Miracles, and various other knotty questions of doctrine.

ANALES DE LA OFICINA METEOROLOGICA ARGENTINA (Annals of the Argentine Meteorological Office). Under the Direction of WALTER G. DAVIS. Vol. VIII, 1886. Buenos Ayres. Pp. 596.

THE general course of the office corresponded with that of previous years. Numerous valuable observations were received from points well distributed throughout the republic, the results of which have been found useful in advancing the knowledge of climatological laws, for both practical and scientific purposes. New instruments have been added to the apparatus, or old ones replaced. Observations have been begun or renewed at six new stations, and reports were registered from twenty-three stations or separate observers. The system of observations at the central office has been greatly improved. The temperature of the soil has been taken at different depths down to twelve feet. The monthly means are given in the beginning of the report from twelve stations, of temperature, atmospheric pressure, humidity, pressure of atmospheric vapor, rainfall; and hourly means from the naval school and Cordoba, as well as temperature of the soil, wind direction and velocity, ozone, solar heat, and rainfall at Cordoba. The principal meteorological phenomenon of the year was the great snowfall and frost of the 19th, 20th, and 21st of September, which caused much injury to agriculture and cattle through the whole of the republic. Its history and course are traced from its origin in the Cordilleras, on the 16th, to the Atlantic. The director hopes that, with the advancing settlement of the country and the extension of means of communication and telegraphs, improvement may be gained in the knowledge of the laws of the meteorology of the country and the means of predicting changes of weather commensurate with that which has been realized in local observations. The volume is mainly occupied with the record of the detailed observations made at Villa Formosa (capital of the Northern Gran Chaco, two observers), the colony of Chubut, and the city of San Juan.

THE THEORY OF MUSIC. By LOUIS C. ELSON. Boston: New England Conservatory of Music. Pp. 208.

THIS book is designed to furnish an outline for instruction in the fundamental principles of music. There is danger that the musician may become a specialist ignorant of the basis and framework of his art. The author has prepared this text-book as a help toward broader study. The general subjects treated are: Acoustics; The Orchestra; Rhythm and Notation; Musical Embellishments; Instrumental and Vocal Form.

The character of a vibration is first considered. The French define this as motion to one side only, but in England and America it includes the oscillation from side to

side and back to the point of rest. Regular and continuous vibrations produce *music*; irregular vibrations result in *noise*. There are four laws or canons of the stretched string, depending upon its length, thickness, tension, and density. Vibrations become audible when they reach the rate of sixteen per second and vanish at the point of 38,000 per second. Overtones are likened to the wavelets which form part of a larger ocean wave. The sound-waves, however, divide with mathematical regularity, and the laws concerning them were first formulated by Helmholtz in 1863. The number and strength of overtones, or harmonics, cause us to recognize the difference between two instruments, as flute and violin, when sounding the same tone. The musical scale now in use arose to fit the needs of keyed instruments. The voice and stringed instruments can give the natural scale with many more intervals. Pitch has mathematical niceties, and its standard is a variable quantity. Philosophical pitch is determined by subdividing a wire that vibrates once a second. The variety of musical instruments has resulted from employing different vibrating substances, and from exciting vibration in these by several methods. Six classes of vibrations are noted: first, the vibrations of strings; second, of reeds; third and fourth, of elastic membranes; fifth, of solid elastic substances; and, sixth, "the vibrations of air upon itself in a confined space."

A consideration of orchestral instruments naturally follows. These are grouped as the string band, the "wood-wind," and the brass band. In each of these divisions are found four or more instruments that correspond to the soprano, alto, tenor, and bass in a vocal quartet. The modern orchestra dates from 1600; for, although the ancients used many instruments, they performed only unison-music, "while our idea of orchestral music is essentially part-music."

Rhythm, notation, marks of expression, and musical embellishments are fully illustrated. Musical form is next analyzed and traced to an origin in the old dances. The *suite* was "at first a set of dance-movements." In a study of figures and phrasing, the author points out that the *leit-motif* so characteristic of Wagner was first used by Mozart in Don Giovanni. Among the musical forms afflicted with changeable definitions is the symphony, now understood as a sonata for orchestra, but in the early part of the last century known as a prelude, interlude, or postlude. The development of the *sonata*, its various movements and dependent forms, follows, the more important of these being the concerto and classical overture.

The Catholic mass is named as the earliest vocal form. Some vocal forms are the offspring of instrumentation, such as the aria and rondo. Vocal music of any character may be written either in the strophe form, which repeats the music of one verse, or as an art-song, in which the music interprets the poem from beginning to end. The canon, the fugue, and, finally, modern dance forms are subjects of special study.

In conclusion, the author recommends to those wishing to become earnest musicians, ensemble-playing and score-reading. The German language should be acquired for the philosophy and literature of music, but Italian is most important to the vocalist. "Bach should be faithfully studied by every musician," since in him "the intellectual and emotional are so well balanced."

WAR AND THE WEATHER. By EDWARD POWERS, C. E. Revised edition. Delavan, Wis.: Published by the author. Pp. 202. Price, $1.

A BELIEF exists that heavy cannonading and great fires bring on rain. In some places it has been noticed often that a clear morning on the 4th of July has been followed by rain, and this has been attributed to the explosive celebration of the day. Mr. Powers has written his book to furnish definite evidence in support of the belief that rain can be produced by means of artillery, and to advocate the making of experiments by the Government in order to obtain certain proof in regard to it. His evidence consists of a record of those battles in our Mexican and civil wars in which artillery was largely used and which were followed by rain, giving the chief circumstances in each case. An appendix contains letters from army officers, transcripts from diaries, etc., supporting this record. In regard to the fact that artillery-firing does not always bring rain, the author says that the chief

reason is that enough guns are not always brought into action and fired simultaneously, but there may be also minor reasons. He inserts an estimate of the cost of two experiments in which two hundred siege-guns should be used, making the amount $160,000 for the two. After this mode of causing precipitation had become systematized, he estimates that "a good rain-storm" would cost less than $21,000.

THE SEPTONATE AND THE CENTRALIZATION OF THE TONAL SYSTEM. By JULIUS KLAUSER. Milwaukee: William Rohlfing & Sons. Price, $3.

IT is no exaggeration of the condition of an average musical student that Mr. Klauser describes in the introduction to this work. After pursuing the study of music for ten, fifteen, or twenty years, he may still be unable "to tell you what the intervals, chords, rhythms, and meters are that you dictate for oral discrimination." He has learned to use his voice or some instrument. His eye, hand, or vocal organs may be trained, but the cultivation of his ear has been left to chance. "Students are not taught, nor do they learn, to hear." A system of teaching which turns out pupils ignorant of the elements of their art, and liable to be embarrassed by simple questions, must be faulty. The author of this volume holds that there are two fundamental errors in musical training: one, the inverse method of instruction, in which a pupil is taught to perform before he can listen intelligently; the other, the usual presentation of the tonal system. As a remedy for the first, the beginner should be taught to hear exactly and discriminate from the start. A corrective for the second demands a reconstruction of our tonal conceptions. "The scale is too complex a unit; . . . its combinations are too multiple for any beginner to grasp as a whole." After much investigation of tonal relations and analysis of the mental process of musical reproduction, Mr. Klauser has fixed upon the scale-half or tetrachord, and the union of two scale-halves with a common central tonic, as simpler elements for tone-study. To the latter group of tones he gives the name of septonate, "seven principal tones in their natural positions," three preceding and three following a tonic. Other divisions of tones, which are the framework of the system, are the key-group and the tone-stratum. The key-group contains seventeen tones, consisting of the septonate and ten other tones; five sharps, called *up*-mediates, and five flats, the *down*-mediates. Ten more tones, named secondary intermediates, added to the key-group, complete the tone-stratum. A new theory for tone discrimination is introduced in the Principle of Progression. In hearing a series of tones, "we are disposed to progress on certain tones and to stop on others." The tones from which we feel a desire to move are called *by-tones;* those which create a feeling of rest are *harmonics.* The author explains these phenomena as the result of the antagonism or agreement which certain tones have with the melodic phrase already in mind, and which he calls "the governing voice."

The author argues the need of a new notation, and may hereafter attempt that Sisyphean task. Prefixed to this volume is an interesting and suggestive essay on a higher education in music. Some experiences in training children deficient in tone-sense deserve attention. The relation of music and mind is exhibited in the fact that music must be executed in a prescribed *tempo*—"the moments of cognition are limited." So "a concentrative power without parallel" is cultivated. In concluding the volume, various views of the origin of music are given, the author believing that music antedates speech, as the chromatic intervals of the wind and the melodious phrases of birds preceded the existence of man.

ELEMENTS OF CRYSTALLOGRAPHY. By GEORGE H. WILLIAMS, Associate Professor in the Johns Hopkins University. New York: Henry Holt & Co. Pp. 250. Price, $1.25 net.

THIS text-book, which is offered to students of chemistry, physics, geology, and mineralogy, contains as much of the subject as any one who does not intend to make mineralogy his life-work will need to know. It describes the several crystallographic systems, taking up a considerable number of the combinations possible under each, and giving diagrams and symbols. There are also chapters on Crystal Aggregates and Imperfections of Crystals, and an Appendix on Zones, Projection, and the Construction of Crystal Figures. To the student of miner-

alogy this will, of course, be an elementary volume; accordingly, a list of books is given, mostly German, in which fuller information can be found. There are 383 cuts in the volume.

READER'S GUIDE TO ECONOMIC, SOCIAL, AND POLITICAL SCIENCE. Edited by R. R. BOWKER and GEORGE ILES. New York: Society for Political Education. Pp. 160. Price, cloth, $1.00; paper, 50 cents.

WITHIN the past decade a very noteworthy increase of interest has taken place in economic, social, and political science. Its literature to-day flows in a stream many times as wide as that of 1881, and, passing the limits of the monographs and reviews specially devoted to it, now finds its way into popular magazines and leading journals. The quickening of interest which this denotes is not without a reason. Every year brings its enlargement of the functions of the state and some fresh appeal for yet wider extension of its scope. Interstate commerce is one of the more significant of its accessions of sway in recent years. It would seem that the guardianship of forests and the supervision of irrigation are to be among its duties in the near future. With authority in international trade to speak the word of good or ill fortune, Government is constantly being asked to step into the arena of domestic industry. Why may not the power which claims to bring prosperity by a tariff be invoked to regulate immigration, fix the hours of labor, or otherwise become as a Providence to the nation? With a literature teeming from the press treating these and allied questions—questions of the creation of wealth and its distribution; Government, and its relations to the commonwealth—such a guide as that provided by the Society for Political Education is clearly invaluable. Its editors present a classified list of the leading books, articles, Government and other reports, in the various fields covered by the manual. Each department has been revised by a competent specialist; and where, as in the case of free trade and protection, there are opposed camps, a representative of each has co-operated with the editors. The book is not a mere list, but a trustworthy guide, every work of importance receiving a brief descriptive or critical note. Prefixed to the several sections, wherever desirable, are a few lines advising the reader or student which books are best, and in what order they may most profitably be taken up. The titles have been selected not only from American and English, but from German, French, and Italian works. That foreign literature is very much richer than our own in economic and social science is a fact which this little book brings out very clearly. In emphasizing it, something will be done to broaden the outlook of American students, too often content with home authors not of the first rank. Lists for reading, elementary, intermediate, and advanced, are prescribed. The courses in politics and economics in leading American colleges for men and women are epitomized; and a very full index doubles the value of the book.

Those who have a taste for speculations on abstruse scientific questions will be interested in *Cosmical Evolution*, by *Evan McLennan* (Donohue, Chicago). It is a new theory of the physical universe, which substitutes for gravitation a system of bonds connecting the stars and planets as chemical atoms and molecules are assumed to be connected. The author's handling of the subject gives evidence of much ability.

Under the title *Manual of Archæology* Mr. *Talfourd Ely* publishes a sketch of ancient art (Putnam, $2). It is divided into two books, the first relating to Prehistoric, Egyptian, and Oriental Art, and the second to Greek, Etruscan, and Roman Art. The art of these countries is described as displayed in architecture, sculpture, engraving, painting, enameling, mosaic, and in the industrial arts. At the head of each of the eighteen chapters is a list of books recommended by the author for further reading. The work has an index, and contains one hundred and fourteen illustrations.

The *Third Annual Report of the Agricultural Experiment Station*, at Cornell University, covering the year 1890, comprises the separate reports of the several officers of the station, together with the collected bulletins that were issued during the year. These reports are largely devoted to descriptions of the buildings and laboratories that have been provided for the use of the station, illustrated with views and plans. The

bulletins, most of which have been noticed in this magazine, deal with corn-growing, the examination and care of milk and cream, spraying plants, fruit-growing, tomatoes, insects injurious to plants, the clover rust, and a variety of minor investigations.

An Examination of Fingal's Cave, by *J. P. MacLean* (Clarke, 75 cents), is an account of this famous cavern enlarged from a report made by Prof. MacLean to the Smithsonian Institution in 1887. The island of Staffa contains several caverns besides the one of chief prominence, and these receive brief mention. The author's description of Fingal's Cave consists mostly of Sir Joseph Banks's account of his visit in 1772, which is inserted in full, and quotations from other sources. The origin of the cave is discussed, and reasons are given for not believing it to be the work of man. The volume is illustrated from drawings by the author and from other sources.

Harper's Sixth Reader (American Book Company, 90 cents) is devoted to British authors, and completes the series to which it belongs. Attention is called by the publishers to the gradation in the several classes of selections as they are herein arranged: those pertaining to modern history occur in chronological order, so also do the articles on Roman life and customs. Among the lessons are views of American institutions from English standpoints, examples of the best of British fiction and humor, and essays on questions of morals and personal duty. While many of the selections are new to school readers, a large number of acknowledged classics are also included. Both the living and the earlier writers are represented. Notes on the author and on the unusual words of each piece are appended.

The paper of Mr. *George M. Dawson*, of the Geological Survey of Canada, *On the Later Physiographical Geography of the Rocky Mountain Region in Canada*, is a monograph of a like order of those of which members of our own Geological Survey have produced a large number. Relating to what is virtually an extension into the British Provinces of the identical regions with which our own geologists are concerned, it may be grouped with their special memoirs as constituting one of a mass of materials by the aid of which American geology is being shaped into a more extensive, systematic, and harmonious scheme than has been applied to any other region. The western border region of the continent is defined by Mr. Dawson as being formed by a series of more or less nearly parallel mountain systems, with an average breadth in British Columbia of about four hundred miles, and tending in a direction similar to that of the Pacific shore line, the position of which in fact depends upon that of these orographic features. In traversing this generally mountainous zone—which the author calls the Cordillera belt—from east to west, we cross the Rocky Mountains; what may be classed together as the Gold Ranges (including the Selkirk, Purcell, Cariboo, and other ranges); the Coast Ranges; and an irregular mountain system—the Vancouver system—of which Vancouver Island and the Queen Charlotte Islands are unsubmerged parts. A region between the mountain and the Coast Ranges, without important mountain ranges, is referred to as the Interior Plateau of British Columbia. The paper has special reference to changes in elevation and the history of the Glacial period, and is divided into two parts: I. Mesozoic and Tertiary History; and II. Glacial History.

The Fruits of Culture is a comedy in four acts by Count *Leo Tolstoï* (Tucker, Boston). It deals with spiritualism, the principal scene being a bogus *séance*. The characters are Russian nobility, learned persons, servants, and peasants.

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POPULAR MISCELLANY.

Photographs in Aid of Road Improvement.—The New York and Connecticut divisions of the League of American Wheelmen have united in offering three prizes, of $50, $30, and $20 in gold, for collections of not less than three photographs showing the need of improved roads in the United States. The circular sent out by the committee states that the kind of pictures wanted are such as show a farmer's wagon and team hub-deep and knee-deep in a muddy road, break-downs caused by rough or muddy roads or steep grades, and, for contrast, those showing teams hauling loads

over smooth, hard-surfaced roads. By this action the bicycle-riders show a readiness to do their share toward securing improvements that are important to all users of roads. Competitors' blanks and particulars will be sent by Isaac B. Potter, 278 Potter Building, New York, or Charles L. Burdette, Hartford, Conn. The competition closes May 1, 1891.

New Metric Standards.—Prof. Mendenhall exhibited at the last meeting of the American Association exact copies of the new metric standards received by the United States Government from the International Board of Weights and Measures. The standards, when received, were opened formally in the presence of the President and Secretaries of State and the Treasury and sixteen specially invited scientific men, and duly certified to, as was done with the standard troy pound during the administration of John Quincy Adams in 1828. The meter is a rod with H cross-section, made of an alloy of platinum and iridium. In making these standards for the various governments, two thirds of all the iridium known in the world was used. The extreme delicacy and exactness of the measurement work done upon the standards was illustrated by saying that when two of the standard kilogrammes were balanced against two similar masses, if one of the masses on one side of the balance was placed on top of the other mass, the balance would be destroyed. In other words, raising the mass of one kilogramme through less than two inches made a difference in the attraction of the earth readily observed.

Some North Dakota Mounds.—Mr. Henry Montgomery, between 1883 and 1889, excavated and explored thirty-nine ancient artificial mounds in North Dakota. They consisted of one beacon mound, one well-marked sacrificial mound and another not so well marked, and thirty-six burial mounds. The burial mounds were of two kinds. The ordinary burial mound consisted of a circular, rounded, or conical heap of earth, mostly rich, black soil from the prairie, clothed with grass, and rising generally to a height of several feet above the surrounding level. One or more vaults occur in each, in which human skeletons and various implements, ornaments, trinkets, etc., are found. A single vault is near the center; two or more vaults are found eccentric in situation, and at varying distances from one another. The vault is a circular, well-like pit, having a calcareous bottom and wall, and often also a calcareous covering. In digging for the vault—which was done systematically, a foot at a time, the level being carefully preserved—wood was found at the depth of about a foot, consisting of poles or young trees, varying in diameter from three to ten inches, charred at their ends and over the greater part of their surfaces. The skeleton was generally found in a crouching posture, with back against the wall and face toward the center. The second kind of burial mound is distinguished by having no wood and no burial chambers, and in the bones being broken and scattered. A third kind of mound, containing a layer of clay that seems to overlie many human skeletons, is hardly distinctly enough defined to be constituted a separate class. A well-defined sacrificial mound was explored by the author on the south side of Devil's Lake. Another mound, somewhat resembling this, was opened near Sweetwater Lake in July, 1889. A beacon mound in Beacon County was explored in September, 1887. The mounds are situated on high ridges and hills, composed often of drift clays and bowlders, and sometimes of gravel and sands.

Prehistoric Traps.—Some curious wooden machines fished up from European peat-bogs were described by Dr. Robert Munro, in the British Association, as probably prehistoric otter and beaver traps. Two of them, which were taken as typical, were found in the great Laybach Moor, in the vicinity of the famous group of lake-dwellings there under investigation. The more perfect of the two was made of a solid piece of oak thirty-two inches long, twelve inches wide, and four inches thick. It tapered a little at both ends, and contained a rectangular hole in the middle, nine inches long and five inches wide, for a valve, which was worked by pivots projecting into corresponding holes in the framework. The valves were freely movable when pushed upward, but the motion was arrested a little short of the perpendicular by the slanting shape of their

after-edges, so that when left to themselves they always fell down, and so closed the aperture. Somewhat similar machines have been found in Ireland, north Germany, Styria, and Italy, and their character has been the subject of discussion. They are usually regarded as traps, and it is remarked that all the examples from Italy, Ireland, and Laybach were found in bogs which in earlier times were lakes. If they were really traps, they could be used only in water, where the animal could insert its head from below; and, among amphibious animals, the otter and beaver are the only ones to which all the conditions involved in a trap theory would apply.

The Qualifications of a Good Nurse.—"Now in what," asks Dr. Hal C. Wyman, in an essay on The Training of Nurses, "shall the ideal nurse be trained? She should have a good education. She need not be schooled in mathematics or philosophy, poetry or science; but she must have a good common-school education that will enable her to read any instructions that may be given her, or left with her, in writing; to make records of the condition of the patient, and to write orders for those who may be subject to her. . . . She must be fully acquainted with the English and the metrical system of weights and measures, and she ought to be a good reader, sufficiently well acquainted with the art of elocution to read various selections for the entertainment of her patient. One of the most interesting scenes of hospital life I ever witnessed was that of a Gray Nun in a ward of paralytic and demented patients, reading the news of the day. The soft modulations of her voice, the rapt attention of her listeners, and the agreeable contrast to the listless, weary air of the patients in an adjoining ward I shall never forget." Not only should there be trained nurses in large cities and in connection with large hospitals, but they are needed "in communities where there are no large hospitals, in communities where there are no hospitals at all, and there ought to be some means of training them on the ground where they are needed. Every county, nearly, has its organization for the medical care of the sick poor. That class, more frequently than any other, needs the tender and supporting ministrations of the nurse. Why not, wherever there are physicians employed by the county, have the county physician, with the aid of the superintendents of the poor, organize a school for the training of nurses?"

Reversion, or Arrested Development.—In a paper in opposition to the doctrine of reversion to a former type, Miss Layard said, in the British Association, that in considering the subject of linear evolution the great importance of a clear understanding of the laws of reversion is apparent; for, if it can be positively proved that structures common to lower groups occasionally make their appearance in man through this means, a strong point has been gained. It is logically certain that there can not be a return to a state which has not once existed. But if, on the other hand, such appearances can be traced to an arrest during the process of development, or to a sport, the phenomenon shows no connection between higher and lower groups. If we carefully divide positive cases of arrested development and sports from those which may be, strictly speaking, considered to have true appearances of reversion, the number diminishes enormously. Perhaps the most important point to be ascertained is as to the limit of time after which reversion to an earlier type becomes impossible. If there be no limit, then it may be a matter of surprise that reversion is not more constant in man.

Storage Reservoirs for the Mississippi.—Captain Eads's scheme of jetties and all other plans for improving the Mississippi River by tinkering with the channel are condemned by Mr. Jacques W. Redway, in a pamphlet on The Physical Geography of the Mississippi River, as likely to work more mischief in the end than they remedy. The author, on the other hand, advocates a plan embodying the storage of the surplus water that accumulates during the spring floods. This will both lessen the volume of the freshets that occur at the breaking up of the winter season, and also furnish a supply to be drawn from during the low stage of summer and fall. The storage reservoirs in construction at the present time are mainly the natural basins at the head of the Mississippi proper—Chippewa, St. Croix, Crow Wing,

and Wisconsin Rivers. To hold the water subject to control, a dam is to be constructed across the lowest rim of each basin—that is, that part of the rim which is the drainage outlet of the basin. In each case the discharge gate of the reservoir will have an area not less than the cross-section of the stream at low water. It is shown that 95,572,000,000 cubic feet of water may be stored away in the reservoirs on the Mississippi alone. The reservoirs already completed on that stream show an actual capacity of nearly 5,000,000,000 cubic feet more than their estimated capacity. Not all of this water is available for storage, however, as 46,000,000,000 cubic feet are required for the constant flow between May and December, leaving a minimum of 49,000,000,000 cubic feet (with a possible ten per cent more) available for storage. Calculations show that with a low stage of water continuing for four months, the amount to be drawn from the reservoirs would aggregate only 42,000,000,000 cubic feet against an actual amount of 49,000,000,000 cubic feet in the reservoirs. This, if we consider the increased actual over the estimated capacity of the reservoirs, would give 5,800 cubic feet per second that could be spared, while only 4,400 are needed. Including also the reservoirs that might be constructed on the Wisconsin, Chippewa, Crow Wing, and Fox Rivers, the available supply could be increased to a possible 40,500 cubic feet per second for ninety days. The reservoirs, once they are constructed at the sources of these streams, will give a much more uniform volume in the Mississippi, so as to insure a fair stage on all bars, and will also add several hundred miles of navigable waters to the great system of river transportation. These streams are mentioned, not because they are more important than the large rivers below, but because they are the outlets of hundreds of large lakes in the northern part of Minnesota and Wisconsin. Their freshets may be an important factor in the more disastrous floods of the lower Mississippi.

Glacial Action in Niagara River.—Prof. G. W. Halley dissents from Prof. Gilbert's theory of the history of Niagara River, and believes that glacial action was an agent in the formation of the channel. In 1840, he said, a large surface of rock on the bank of the river was removed at different points for the purpose of making certain improvements, and was found to be deeply scored, while the vicinity furnished many granite bowlders. Three branches of drift stone and gravel are developed at Lewiston, and the evidence of glacial action is abundant. These and other facts which the author mentioned point, in his opinion, to the existence and progress of a grand terminal moraine, which was once the boundary of an immense inland sea. So far from the Niagara River carrying no sediment, as Prof. Gilbert assumes, and as one who visits it in summer might be justified in supposing, one who lives near it many years may see its waters running for ten days at a time with a dirty chocolate or dark amber color, and charged with great quantities of sand, gravel, and silt; and could hear in the rapids the gravel and pebbles grinding and scratching their way along the rough bottom. The vast dense bar at the mouth of the river on Lake Ontario is overwhelming proof of its immense scouring properties.

Value of Science in Industries.—In his paper on The Development of the Coal-tar Color Industry since 1880, Dr. W. H. Perkin named various coloring matters which had been discovered during the last ten years, and illustrated his remarks by experiments with different colors. Germany still holds the first position in the market, both as to quality and quantity, but the competition of Swiss, French, and English manufacturers with that country has been steadily increasing. Several years ago the author had expressed an opinion of the necessity of scientific research being made an important part of the training for chemical students, so that highly skillful chemical men imbued with a spirit of investigation might be produced, not only to fill chemical chairs, but also to occupy important positions in chemical works. Hitherto not so much progress had been made in this direction as was desirable, and he feared that this was to some extent due to manufacturers not having as a body sufficiently realized the great importance of employing such men in their works. Thus, the demand being small, the supply necessarily corre-

sponded; but surely the wonderful development of the coal-tar industry, which had been and still was being carried on in such thoroughly scientific spirit, was an example which should not be forgotten. Sir Frederick Abel, the President of the British Association, where the paper was read, was struck with Dr. Perkin's remarks on the reasons why the English had been left behind in the development of that particular industry, and said that there were now great works in Germany where chemical research is carried on as an elaborate business, and was pursued by men who had acquired university degrees and distinction. He knew of one establishment where forty trained chemists were at work on the particular branch of research in which it is interested. If they could get a small army of men in England to pursue the work systematically, they might regain lost ground. In the first years of the coal-tar industry the English claimed it as particularly their own, but now they could not do so in view of the competition of the French and Germans.

The Available Lands of the Globe.—The subject of the lands of the globe still available for European settlement was discussed at a joint meeting of the Geographical and Economical Science Sections of the British Association. Mr. G. E. Ravenstein reviewed the capacity of different parts of the earth, excluding the arctic and antarctic regions as wholly unavailable, to accommodate population. He estimated the total number of persons whom the earth could feed at 5,999,000,000. The kind of population with which it shall be inhabited will depend to a large extent on the capacity of Europeans to thrive in strange climates. He spoke of the tendency of populations to move to the southward, but did not think tropical climates adapted to the acclimatization of European races in the sense in which the word acclimatization is generally used. The health of Europeans in tropical countries had improved in consequence of sanitary measures, but that was not all. Population in some countries did not increase; and, where they could compare the facts collected in the same country, they found that the superior race increased at a slower rate than the inferior race. That would, in course of time, keep back the growth of population, and, in fact, the whole of mankind was being gradually lifted up to a higher level. If only the superior, not the inferior, people increased, the speaker did not think the progress of civilization would be quite so steady. Mr. E. J. Marend, after his experience in Africa, was of the opinion that the prevalent idea that tropical regions are unsuited to colonization by Anglo-Saxons is mistaken. Englishmen live for years in Matabeleland, bringing up their children and keeping their health. Traders, missionaries, and Dutchmen are all able to thrive there, and the country is competent to provide the food-supplies for a large population. Sir R. Rawson believed that the proportion of land in the different zones is as follows: About fifty per cent of the whole is in the temperate zone, about forty per cent in the torrid zone, and about a tenth in the arctic zone. Before going further in dealing with a future home for the surplus population of Europe, we must ascertain the zones that are suited to a European population. The surplus population of England and the north of Europe could occupy only a temperate zone. It was also essential that we should know how much is available in each of the zones. Mr. John Mackenzie's experience had shown him that South Africa is habitable for both the north and south Europeans. The Rev. Dr. Cunningham pointed out that the intensity of production might be much increased through the direction of native agriculture by European intelligence. Mr. Wells, a traveler in Brazil, from whose papers we have quoted, called attention to an area in the south of that country which might be called the Transvaal of South America. To the northwest of Rio lay a considerable coffee-producing area, with an exceedingly healthy climate, and the productive powers of the country were very far indeed from being approximately reached. Several speakers mentioned the necessity of emigrants to the south adapting their mode of life to the changed climate, and insisted on the necessity of temperance. Dr. J. G. Garson said the question of drainage was most important, though it often occurs that the first steps toward sanitation are followed by outbreaks of fever, arising from saturation of the soil by sewage. Elevation above the

sea-level exerted much influence on health, though the great thing for emigrants was to choose a climate as nearly as possible like that to which they were used.

An Experiment in Hypnotism.—Mr. A. Taylor Inness contributes to the London Spectator a curious relation of a case in which a hypnotizing practitioner ventured to stop the beating of the heart of his subject. Calling a physician of the place, who was well acquainted with the subject, to himself, he asked him, "Doctor, will you put your finger upon his left pulse, while I keep mine on his right?" Dr. ——, says the story, "was skeptical and hostile, but at our instance he consented. Keeping one hand on the lad's wrist, Lewis laid the other gently over his heart. Within a minute or two M. —— lost his rich and vivid color, and Lewis counted the decreasing strokes till he announced that they were scarcely recognizable. 'Is that not so, doctor?' he asked. Dr. —— was extremely unwilling to speak; but, under the urgency of some of us who stood by, he at last said, in so many words, that the pulse had almost shrunk to nothing. The boy stood, a ghastly statue, for a minute longer, when Lewis, saying hurriedly, 'The pulse is now imperceptible; we must protract this no longer,' took away his hand from the breast, to the evident relief of his improvised colleague. But it was to the evident relief, too, of their common patient. I remember distinctly to this day the ashen hue even of his lips, and the wonderful gradations through which the blood found its way back into them and into the whole young face—a face still asleep, but now glowing as if it had traveled a long way from the margin of the grave."

Physical Geography of the Mediterranean.—Sir R. I. Playfair said on this subject, in his British Association address, that the Mediterranean must at one time have consisted of two inclosed or inland basins like the Dead Sea, separated by the isthmus between Cape Bon, in Tunisia, and Sicily. The depth between Italy and Sicily is insignificant, and Malta is a continuation of Sicily. The shallows cut off the two basins from all but superficial communication. The configuration of the bottom shows that the whole strait was at one time continuous land, affording free communication for land animals between Africa and Europe. In the caves and fissures of Malta are three species of fossil elephants, a hippopotamus, a gigantic dormouse, and other animals that could never have lived on so small an island. In Sicily remains of the existing elephant have been found, as well as the *Elephas antiquus*, and two species of hippopotamus, while nearly all these and many other animals of African type have been found in the Pliocene deposits and caverns of the Atlantic region. The submersion of this isthmus no doubt occurred when the waters of the Atlantic were introduced through the Strait of Gibraltar. The rainfall over the entire area of the Mediterranean is not more than thirty inches, while the evaporation is twice as great. Therefore, were the strait to be closed, the level of the sea would sink again, and this would affect the Adriatic and the Ægean Seas and a great part of the western basin. At the Strait of Gibraltar an upper current at three miles an hour supplies the sea with the difference between rainfall and evaporation. An opposite current of warmer water flows out at half the rate, carrying off the excess of salinity, but leaving the Mediterranean salter than any part of the ocean except the Red Sea. The almost constant temperature of 56°, compared with 53° to 49° in the Atlantic, enabled Dr. Carpenter to distinguish between Atlantic and Mediterranean water.

Customary Survivals.—Our knowledge of primitive civilization, says Canon Isaac Taylor, in Knowledge, is largely derived from the study of survivals. Survivals may be defined as anomalous traditional usages, seemingly meaningless or useless, which originated in some state of things that has passed away, but which by the force of custom have continued to exist. That the Queen still gives her assent to acts of Parliament in a formula couched in Norman French is, for instance, a survival from the time when the sovereign of England was a Norman duke, unable to speak English. A judge's wig is a survival of the long hair which came in fashion at the Restoration; and the black patch on the crown, with its white fringe, is a survival of the black skull-

cap that was worn over the coif of white silk or linen that formed the head-dress of the sergeants-at-law from whom the judges were selected. The procurations paid to an archdeacon of the Church of England are a money composition in lieu of his ancient right of quartering himself and his attendant horsemen on the parochial clergy during his visitations. Fee-farm rents, as they are called, are in many cases survivals of payments for services no longer rendered. Canon Taylor pays a rent of this kind, which represents a composition for a certain number of thraves or sheaves of corn, which his predecessors in title rendered to the Abbot of Beverley for his services in "correcting the villans" of a certain parish, who might avail themselves of the privilege of sanctuary that was conferred by Athelstan on the monks. The unchronicled history of English villages may be largely recovered from the study of such anomalous survivals. Sir Henry Maine and Mr. Seebohm in England, and Von Maurer and Prof. Nasse in Germany, have made some valuable researches in this line, and Mr. G. L. Gomme has added to them. The last author explains a duplicate municipal jurisdiction that used to prevail at Rochester by assuming that there was a community there of Danish origin, governed by its own laws and officers, but subordinate to the rule of the Saxon community. Canon Taylor also cites a more striking case at Exeter, where Mr. Kerslake has succeeded in delimitating the boundaries of the Celtic and Saxon communities which dwelt side by side within the walls.

Early Printing at Avignon.—Documents have been recently discovered by the Abbé Requin that go to show that printing was practiced at Avignon before Gutenberg introduced it in Mentz. They record that in 1444 one Procopius Valdfoghel (Waldvogel), a goldsmith of Prague, was living at Avignon, and instructed two students there—Manaud Vitalis and Arnaud de Coselhac—in the art of artificial writing and furnished them with the instruments for it, consisting of two abecedaria of metal and two iron *formæ*, a steel screw, forty-eight *formæ* of tin, and other implements. About the same time Valdfoghel instructed one Davin, of Caderousse, a Jew, in the same art; and two years later, on the 10th of March, 1446, he entered into an agreement with the Jew to supply him with twenty-seven Hebrew letters cut in iron, and other implements for the practice of printing. At the same time the Jew agreed not to disclose the art, either in theory or practice, to any one as long as Valdfoghel remained at Avignon or in the neighborhood. A partnership was formed between Valdfoghel and his two former students, from which Vitalis retired in April, 1446, giving up his share in the implements, whether of iron, steel, copper, lead, and other metals, or of wood. He also made oath on the Holy Gospels that the art of artificial writing taught him by Valdfoghel was a true art, and easy and useful to any one who desired to work at it and was fond of it. It is questioned whether this declaration was obtained to avoid the imputation of sorcery, or to commit Vitalis to an assertion that the invention was a successful one. These transactions took place while Gutenberg was still experimenting at Strasburg, and their date, if confirmed, would fix Avignon, instead of Mentz, as the second city where printing was carried on.

Sparrows and Robins.—Another attack on the English sparrow is made by C. B. Cook in a Bulletin of the Michigan Agricultural Experiment Station. No new charge is made against the sparrows, nor is any new proof adduced of the old charges that when too numerous they are a nuisance and that they drive away other birds. We respect, if we do not love them, for the good they have done in clearing city trees of measuring-worms. As to their incompatibility with other birds, we have the witness of one suburb of New York, where the sparrows have been the longest and have multiplied the most, that since the law came in to protect other birds against the man with a gun and the boy with a stone, the robins have been increasing very fast, are not troubled by the sparrows, and during the past spring were more often seen than they. Thus the assertion that man, not sparrows, is responsible for the recent scarcity of song and friendly birds is confirmed. Mr. Cook's paper furnishes an amusing if not pleasant illustration of the folly of offering bounties for the destruction of sparrows.

Nearly five hundred dollars were paid out in Michigan from July, 1889, to March, 1890, "for 15,697 sparrow-heads." Most of the birds, Mr. Cook says, were red-polled linnets —valuable birds. It would perhaps be better to protect the good birds more efficiently and not worry so much about the sparrows. That plan has had excellent results in New Jersey.

Permanency of the Earth's Features.—A paper was read in the American Geological Society by Prof. E. W. Claypole, traversing the doctrine toward which a few geologists are tending, that the sea-beds and the continental masses are permanent and date back to the original consolidation of the earth's crust. After reviewing the several arguments by which this theory is supported, the author concluded that "we have ample evidence of change of level to account for the conversion of the deep sea into dry land and *vice versa*, and that the absence of deep-sea deposits among the stratified rocks is not a valid objection. It would also follow that the depression may occur in any part of the world according to laws as yet unknown, but that when a depression is full of sediment re-elevation is likely to occur; that the deep ocean-beds, instead of being permanent outlines of the earth's contour, are subject to the same laws of elevation that govern the rest of nature. On this view the ocean abysses would be areas of subsidence unfilled by deposit because they were out of the reach of shore action, rather than permanent depressions on the earth's surface."

Democracy and the Churches.—The Influence of Democracy on Religion is the subject of an article in the London Spectator, suggested by the popular enthusiasm aroused by the funeral of Mrs. Booth, of the Salvation Army. The author accepts the story of the Salvation Army, and the story of the Wesleyan movement of the last century, as testimony to the unconscious influence of democratic feeling on ecclesiastical organization; and he believes that the whole character of the Reformation and its offshoots has been gravely affected by the attraction of democratic forms and phases of feeling for religious natures. Both Judaism and Christianity have always placed the poor, and especially the poor in spirit, above those accounted the possessors of this world's privileges; and, as a consequence, these religions have struck at the heart of slavery, and have raised women to the spiritual level of men. The earlier Protestant enthusiasm may have profited by the democratic aversion to specially privileged spiritual orders, like the priesthood and the episcopate. The recognition by the Wesleyans of the ministerial capacity of the laity, and the jealousy against a hierarchy manifested by many other of the Nonconformist churches, gave the religious world a consciousness of the popular advantage which a more emphatic development of the democratic idea in religion bestowed on those churches and sects which were founded on free choice by the laity of their ecclesiastical representatives. The Nonconformists have been compensated for their rejection of state privileges by being brought thereby nearer to the people. The influence of democratic tendencies in other churches is also marked. The universal tendency in Ireland, where the priesthood are of the class which feels most keenly the pressure of democratic principles, to modify and even defy the authority of the Roman Catholic Church in the interest of the peasantry, has been very startling. In England the Episcopal churches, both Anglican and Roman Catholic, are curiously divided between the strong democratic sympathies which their rulers feel under the pressure of public opinion and the natural leaning of their theology against anything like concession to the lawless cravings of the human heart. Roman Catholic dignitaries in England express their sympathy with Irish offenders against the law and with recalcitrant bishops in Ireland. Church congresses discuss social reforms with a disposition to find a middle ground between the old principle of individual right and liberty and the new collectivism. In the United States even Roman Catholic priests take part with the Knights of Labor and ignore the authority of their bishops. English Roman Catholics support earnestly movements known to be popular, and when there is a struggle between labor and capital the greatest man is on the side of labor, often when labor is in the wrong. Everywhere the

spread of democracy is redressing, and more than redresses the balance of religious prepossession. Yet it is certain that no religion will remain popular long which does not put a strong curb on the passions and whims of human nature. This, too, is felt, and the course of ecclesiastics is modified by the feeling.

Shorter Hours and Wages.—An elaborate review of the probable effects on wages of a general reduction in the hours of labor, presented in the British Association by Prof. J. E. C. Munro, brought him to the following conclusions: 1. A reduction in the hours of labor which is neither universal nor uniform will tend to reduce the net product available for division among the producing classes, but such reduction may be lessened or counteracted by greater efficiency in labor and in the use of capital. 2. Capital will be able to throw a portion of the loss on labor, and labor generally will be affected. 3. Any check to the accumulation of capital due to the reduction in the net produce will tend to raise interest and lower wages; but this may be avoided to some extent by the more economic use of capital. 4. The reduction in hours will not necessarily lessen the number of the unemployed, inasmuch as it will not increase the purchasing power of the consumer, and will not affect the chief cause of poverty incident to our present organization of industry. 5. The position of the chronic unemployed, or residuum, will not be materially improved. 6. In so far as additional laborers are employed to maintain the net produce, it will be at the expense of other workers, if the net produce remains the same but the number of producers increases. It is necessary to point out, the author added, that arguments which may be urged against a general, though unequal, reduction of hours do not apply with the same force to a reduction of hours in a particular trade that may be the subject of special economic surroundings. Before venturing to express an opinion on the desirability of reducing hours in a given industry—mining, for example—the economist will require to investigate these surroundings in order to estimate what loss, if any, will occur, and upon whom such loss will fall. But, even if there be a loss in a particular industry or a national loss, it may be more than made good to the nation by the beneficial effects on the working classes of greater leisure. Hence the importance of asking what the working classes will do with the hours they gain from toil. Reasons drawn from current movements were given for believing it probable that, so far as the skilled industries are concerned, the workers would, on the whole, utilize additional leisure in a manner creditable to themselves and useful to the state. Prof. A. T. Hadley, of Yale College, in the discussion of this paper, cited the results of an investigation which was made ten years ago into the relative output of ten-hour workmen in factories in Massachusetts and eleven-hour men in Connecticut. The result was in favor of ten hours in Massachusetts, and was proved not to be owing to any difference in the health of the workmen, but largely to the fact that the workmen of the Massachusetts mills were of a superior class to those of Connecticut. There was a process of a sort of natural selection going on among those who did not mind the long day and could not stand the increased pace of the short day, and those who cared more for the extra hour of leisure and minded less the necessity of increased exertion.

Fast and Fugitive Coal-tar Colors.—In a paper on fast and fugitive coal-tar colors Prof. J. J. Hummel, in the British Association, contradicted the idea that the modern coal-tar colors are all fugitive while the colors of the older vegetable dye-stuffs are all fast. There are fast and fugitive dyes in both classes. We have now about five hundred distinct kinds of coal-tar colors, of which about thirty are extremely fast and an equal number or more are moderately fast. On the other hand, out of the thirty or so natural dye-stuffs usually employed we count ten as giving fast colors. We have, therefore, a total of about three times as many fast coal-tar colors as of fast natural dye-stuffs. This pitting of natural as against artificial coloring matters ought now to cease. Of course, it is not to be denied that we have a very large number of fugitive coal-tar dyes; and the indiscriminate use of these, due largely to competition, has, no doubt, injured the reputation of the whole class. The question, often asked, whether there is no

method of rendering the fugitive colors fast, must be answered in the negative. The fast or fugitive character of a color is an inherent property of the coloring matter used, and depends mainly, if not entirely, upon its chemical constitution. In order to improve the fastness of coal-tar colors we should examine thoroughly the characteristic of every coloring matter, then choose the fastest and reject the rest, or only employ them when they are perfectly admissible. Such a process of selecting the fittest has gone on in the past with reference to the dye-woods, and such is the sifting process now at work among the coal-tar colors. Side by side with this must run the selection of the most brilliant and most easily applied of the fast colors, so that the ultimate goal of perfection to which we would thus attain would be to have all our colors fast, brilliant, and easily applied. Given a good range of brilliant colors, it becomes possible by their varied combinations to produce the most peculiar, pleasing, and attractive shades of grays and olives and browns, and the thousand and one delicate tints beloved by the artist; and they yield when desired a richness and life and body of color compared with which older colors are poor and lifeless. Let the artist, inexperienced perhaps in the application and proper use of coal-tar colors, confine his attention, if he wishes, to the more somber and older dye-stuffs, but do not allow him to persuade you that there is no beauty or permanence or other quality of excellence in any of the coal-tar colors of to-day.

NOTES.

Prof. F. V. Riley takes a hopeful view of the promise of good results to come in apiculture from experiment and investigation. He pointed out, in his address last fall before the Society of Economic Entomologists, as one of the most inviting fields the search for new varieties or species of bees and their introduction; "for just as American apiculture has profited in the past by the importation of races like the Italians, Syrians, and Carniolans, there is every prospect of further improvement by the study and introduction of such promising races as are either known to occur or may be found in parts of Africa and Asia." The further study of desirable bee forage plants, and the introduction and acclimatization of such as are known to be valuable to parts of the country where they do not yet occur, are very desirable.

A new spice adulterant is described by Frank A. Hennesey, Ph. G., in The Pharmaceutical Era. It consists of ground crackers made from a very low grade of wheat—but little better than cattle-feed. The powder thus obtained is colored yellow with turmeric, black with charcoal, brown with Spanish brown and turmeric, etc., according to the spice it is to adulterate. The biscuits are made in a steam bakery in Philadelphia, and large quantities of them have been delivered to a certain spice house in the same city. The presence of this adulterant can not be detected except by a chemical analysis of some difficulty. Ordinary cracker dust has also been used for this purpose.

A correspondent of La Nature, from Bagdad, describes a shower of rain accompanied by a fall of "manna," that took place in August, 1890, around Mardeen and Diarbekir. A surface about ten kilometres in circumference was visited. The nutritious substance was picked up by the people and made by some of them into bread, which had a pleasant taste and was easily digested. A specimen of it sent to La Nature was in the form of spherules, about as large as millet-seed, agglutinated together; was yellowish on the outside and white within. It proved, after a botanical examination, to be a lichen (*Lecanora esculenta*), which, according to Decaisne, is common in the arid mountainous regions of the Tartarian desert, where it lies on the ground, distinguishable only by the most practiced eyes from the gravel with which it is mingled. Parrot told, in 1828, of a shower of it which fell in Persia, where it was collected by the people and was greedily eaten by cattle. The particles had probably been taken up by some whirlwind and separated from the accompanying sand while passing through the atmosphere.

A bold device, which will also furnish a new source of excitement, is suggested by M. Aristide Berges, a French engineer, in the shape of an elevator-car to fall, with its passengers, through a thousand feet, or the height of the Eiffel Tower. During its fall the machine will acquire a velocity of about 250 feet per second, or more than twice that of the swiftest express train. The car will be built in the form of a long cone, strengthened by inner cones which will act to prevent the sudden compression of the air within the chamber, and will be about thirty feet high. To break its fall, a well of water will be provided, 160 feet deep, into which the machine will descend, and sink so gradually as to remove the sensation of shock. A picture is published by the designer showing the car carrying fifteen people in its headlong journey.

A UNIQUE collection of migrating birds formed at Heligoland during forty years by Herr Gätke has been bought for England by Mr. Henry Sebohm, and is to be deposited in the natural history department of the British Museum.

OBSERVATIONS made on Venus to test the conclusions of M. Schiaparelli respecting its rotation, indicate that the rotation is slow, and is made in such a way that the relative position of the spots and terminator do not go through any notable change during many days; that the time of rotation of the planet does not differ more than thirty days from its sidereal period of revolution (about 225 days); and that the axis of rotation of the planet is almost perpendicular to the plane of its orbit. These conclusions support those deduced by Schiaparelli from an extended discussion of all the observations of the planet.

A CURIOUS instance of protective mimicry in a toad is described by Mr. Robert Snordy, of Durham, England. The muscles of the batrachian's body were (as usual) arranged in such a fashion that the back of its head "looked like minute nodules of dark gravel imbedded in a damp path below trees." On top of this gravel-like arrangement of muscles was spread a mesh or network of very fine lichen, with oval-shaped leaves of lightish-green color, connected more or less to each other by a hair-like process of stems. This lichen spread irregularly over the toad's back, and odd sprays of it were also to be seen on the legs and upper surfaces of the feet. "Now," says Mr. Snordy, "had the toad been in its regular haunts under t e trees and shrubs, with this wonderful counterfeit of gravel and protective coloring, it would have been almost impossible to discriminate its form from the dark gravel, lichens, moss, wood, sorrel, and dead leaves of the place; and I doubt not that this animal's unobtrusive attire would aid it materially in capturing the insects necessary for its subsistence."

IN Paris compressed air is supplied to houses through pipes for working elevators, and also for refrigerating purposes.

AN Edinburgh physician writes to the London Times that he has driven a horse, without shoes, on a tour of over four hundred miles, and afterward used him on paved and macadamized streets, without the animal showing any signs of lameness or tenderness. With two larger horses the experiment failed. In slippery weather the unshod horse proves far more sure-footed than a horse with roughened shoes. The doctor concludes that where the growth of the hoofs is strong and rapid, horses are the better for not being shod, especially in the country. The front of the hoofs may have to be rasped away a little, but the sole of the foot is left untouched.

THE ratio of the circumference to the diameter of the circle was calculated by Archimedes as 22:7; P. Metius made it 355:113. Now Shanks has fixed it, after a very long calculation, as far as 530 decimals, and Rutherford has verified his results up to the 440th decimal. Omitting the integer and taking only the fractional part of π, in the decimal notation, he has found that the first twenty figures added together give 100; the alternate figures in the odd series (first, third, etc.) give 45; and the alternates of the even series (second, fourth, etc.) give 55. A curious triple coincidence, but one that has no meaning.

A NUMBER of experiments on the comparative palatability of insects, etc., are recorded in Nature, by E. B. Tichener and F. Finn. The insects experimented upon—consisting of beetles, moths, bees, etc.—were offered to domestic mice, common toads, and a common mynah (*Acridotheres tristis*). The results evinced considerable variability and some caprice in the tastes of the animals fed, but do not indicate that their appetites were voracious for the delicacies given them. The stronger beetles were taken with some hesitation. The mice declined to take bumble-bees; the mynah ate wasps greedily; the toads readily took wasps and bees, and were often stung, without seeming to pay much attention to the accident. The cockroach was eaten by the toads. The mynah for a long time refused it, and only took it, as well as the earthworm, finally, in the dearth of other insects. A few centipeds were given to the mice and the mynah, but were never eaten, though the mice, in one case, eagerly seized and killed a large specimen.

A STRIKING example of law-making defeating its own purpose is furnished in India, where a bounty offered for killing poisonous serpents has led the natives to breed the reptiles as a source of income. This recalls a former practice in Australia, where a reward was paid in one district for the feet of rabbits, and in another district for their heads. As a result the heads and feet became objects of exchange between the inhabitants of the two sections.

AN instance of transmission of an acquired mental peculiarity is given by Pastor Handtmann, of Seedorf on the Elbe, to the German Anthropological Society. It occurred in the case of a farmer who always wrote his first name "Austug" instead of "August," and his daughter. Inspecting the school, some years after his first acquaintance with it, the author heard a little girl read "Leneb" for "Leben," "Naled" for "Nadel," etc. She was the daughter. The farmer had been remarkable for his habit of shifting the consonant sounds of words, which had originated in a fall some time before the birth of the daughter.

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